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COMPTON'S PICTURED ENCYCLOPEDIA AND FACT-INDEX

Interesting · Accurate · Up-to-date

TO INSPIRE AMBITION
TO STIMULATE THE IMAGINATION, TO PROVIDE THE
INQUIRING MIND WITH ACCURATE
INFORMATION TOLD IN AN INTERESTING
STYLE AND THUS LEAD INTO
BROADER FIELDS OF KNOWLEDGE,
SUCH IS THE PURPOSE OF
THIS WORK



Volume 5
1956 Edition

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1956 EDITION

COMPTON'S PICTURED ENCYCLOPEDIA

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Here and There in This Volume

AT ODD TIMES when you are just looking for "something interesting to read," without any special plan in mind, this list will help you. With this as a guide, you may visit faraway countries, watch people at their work and play, meet famous persons of ancient and modern times, review history's most brilliant incidents, explore the marvels of nature and science, play games—in short, find whatever suits your fancy of the moment. This list is not intended to serve as a table of contents, an index, or a study guide. For these purposes consult the Fact-Index and the Reference-Outlines.

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KEY TO PRONUNCIATION

Pronunciations have been indicated in the body of this work only for words which present special difficulties. For the pronunciation of other words, consult the Fact-Index. Marked letters are sounded as in the following words: *cāpe*, *āt*, *fār*, *fāst*, *whqt*, *fqll*; *mē*, *yēt*, *fērn*, *thére*; *īce*, *bŷt*; *rōw*, *wôn*, *fôr*, *nôt*, *do*; *cûre*, *bŭt*, *rude*, *full*, *bûrn*; *out*; *û*=French *u*, German *ü*; *gem*, *gō*; *thin*, *then*; *ñ*=French nasal (*Jean*); *zh*=French *j* (*z* in *azure*); *κ*=German guttural *ch*.

FABLES Everyone knows the nursery story of the three little pigs who went out into the world to seek their fortunes. The first pig made a house of straw, the second built his of sticks, but the third toiled long and hard to make his house of bricks. A wolf blew down the two frail houses and ate the little occupants, but with all his huffing and puffing he was unable to knock down the brick house. In this story the little pigs display human characteristics. The two shiftless and lazy ones are destroyed while the industrious pig is rewarded by escaping their tragic end.

A story of this kind which usually contains a pointed moral lesson is called a "fable." The moral of the story may be emphasized as in the case of the little pigs, by showing the direct results of good and bad actions. Or it may be suggested indirectly by making fun of human weaknesses and follies. The characters in fables most frequently are animals, but occasionally they are men, gods, or even man-made objects.

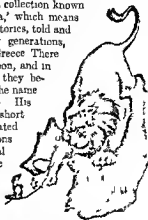
Fables have been common among all peoples from very early times. Probably they were preceded by animal stories told simply for their entertainment value without any moral. As people became interested

in problems of behavior, however, such stories were found useful in teaching the right forms of conduct. Many of our fables go back to very early sources in India—to a collection known as 'The Panchatantra,' which means

'five books.' These stories, told and retold through many generations, found their way into Greece. There they were enlarged upon, and in the 5th century B.C. they became connected with the name of Aesop (see Aesop). His stories are simple, short moral lessons illustrated usually by the actions and speech of animal characters. Some of the better known fables by Aesop are 'The Lion and the Mouse', 'The Fox and the Stork', 'The Hare and the Tortoise', 'The Wolf in Sheep's Clothing', 'The Fox and the Grapes', 'The Frogs Desiring a King', and 'The Shepherd Boy and the Wolf'.

In the story of 'The Lion and the Mouse', Aesop tells of a lion that, tired with hunting, lay down to sleep under a shady tree. A mouse ran over the lion's face and awakened him. The angry lion was about to crush the offending mouse with his large paw, but the mouse pleaded so earnestly for his life that the lion let him go. Some time later the lion was caught in a hunter's snare. The mouse heard the lion's surprised roar, recognized his voice, and ran to the trap. He gnawed the ropes that held the lion and set him free. Needless to say, the lion was very grateful to his tiny friend, and he thought to himself: 'Sometimes the weakest can help the strongest.'

In another of Aesop's favorite tales, 'The Fox and the Stork,' we are reminded that a trickster may be outwitted by his victim. A fox invited a stork to dinner and served the soup in a shallow dish. The poor stork, of course, could only moisten the end of his long, narrow bill. The fox, making false apologies, went ahead and lapped up all the food. The stork pretended to be satisfied and in his turn invited the fox to a meal. When the fox arrived on the appointed day, he found the food served in a narrow-necked jar. Down into the jar went the stork's long bill, while the fox had to content him-

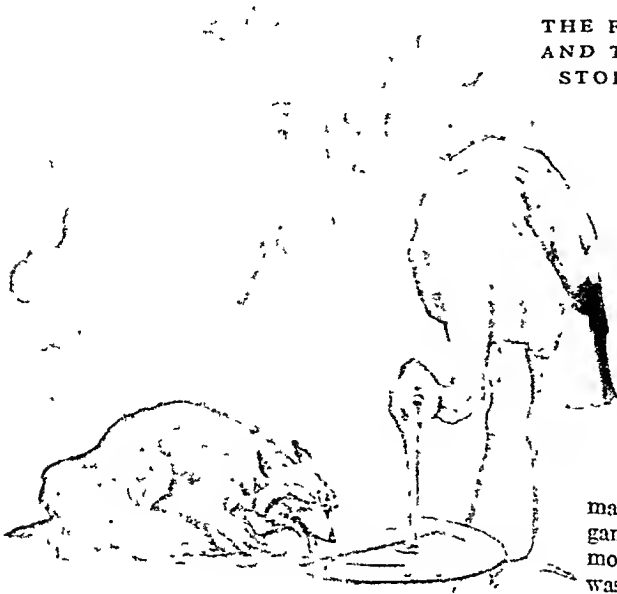


THE MONKEY AND THE CAT



The Monkey persuaded the Cat to rake the roasted chestnuts out of the fire. The Monkey ate the food the Cat gets burned paws.

THE FOX AND THE STORK



The cunning Fox enjoys his meal—while the poor Stork goes hungry. However...

self with licking his chops hungrily. The ancient proverb that "he who laughs last laughs best" may have been suggested by this fable.

The Origin of Some Everyday Sayings

Many of our present-day proverbs and maxims are condensed expressions of the wisdom found in various fables. A few of our more common sayings are listed in the table on the opposite page, together with the fables from which they are derived.

Aesop's stories were collected and written down by his fellow-countrymen and later translated by the Romans. In their Latin form they were used as textbooks in medieval schools. In the 13th century they were translated into French. About a century earlier had appeared the first of many versions of the long folk tale of Reynard the Fox, a crafty and bold animal successful against all his opponents (see Fox).

In the 17th century, Jean de La Fontaine—one of the best-known fabulists—raised the fable to the level of true poetry in his graceful and charming verses, known to all French school children. He rewrote the old fables of Greece and India with a sly humor directed against the evils and abuses of his day. Ever the artist of words, he told his stories in flowing, supple phrases. The great French author Voltaire admired La Fontaine's writings so much that he bestowed upon his countryman this praise: "In most of his fables, he is infinitely superior to those who wrote before and after him, whatever language they may have written in."

La Fontaine based many of his tales on the fables by Aesop, to which he added his own incomparable poetic touch. Thus we find 'The Fox and the Crow', 'The Dove and the Ant', 'The Fox and the Grapes', 'The Maid and the Pail of Milk', and 'The Fox and the Stork' in the writings of both men, although in some instances La Fontaine's titles may vary slightly from Aesop's.

The story of 'The Fox and the Crow' is one of the classics among fables. It tells how a fox saw a crow fly off with a piece of cheese in its beak and settle on a branch of a tree. The fox wanted the cheese for himself; so, being a wily fellow, he walked to the foot of the tree, looked up at the crow, and said: "Good day, Mistress Crow. How well you look today! I feel sure that your voice must surpass that of other birds, just as your figure does. Let me hear you sing but one song so I may greet you as the Queen of Birds." The crow began to caw her best; but as soon as she opened her mouth, the piece of cheese fell to the ground and was snapped up by the fox. "That will do," said he. "That was all I wanted. In exchange for your cheese I'll give you a piece of advice for the future. Do not trust flatterers."

One of La Fontaine's best-known fables is 'The Monkey and the Cat', which is illustrated on page 1. Another of his admired tales is 'The Animals Sick of the Plague'. In this story, the lion (who is the king of beasts) asks all the animals to confess their



... The Stork gets even by inviting the Fox to eat dinner from a long-necked jar.

FAMILIAR SAYINGS DRAWN FROM FABLES

The race is not always to the swift In *The Hare and the Tortoise*, the tortoise wins the race because the hare being very sure of himself takes a nap on the way

Killing the goose that lays the golden eggs *The Goose with the Golden Eggs* tells that the owner not satisfied with one golden egg a day cuts the fowl open to see if there is gold inside

Sour grapes In *The Fox and the Grapes* the fox is unable to reach the tempting grapes hanging high above him so he says the grapes are sour and not fit for a gentleman eating

Don't count your chickens before they are hatched In *The Maid and the Pail of Milk*, a girl thinks about the eggs she will buy when she sells the milk she carries in a pail on top of her head She will then sell the chickens that hatch from the eggs and with the money she will buy some fine clothes Thinking about the new clothes makes her so happy that she tosses her head gaily and spills all the milk

One good turn deserves another *The Dove and the Ant* tells us how a dove saves an ant from drowning in a river Later on the ant saves the dove a life by stinging a hunter in the foot and causing him to miss his aim at the bird

Practise what you preach In *The Wolf and the Lamb* a wolf makes a speech in which he urges his brethren to share their food with one another Then an ass informs the listeners that the wolf is hiding a fat sheep in his lair

Familiarity breeds contempt *The Fox and the Lion* tells us that a fox is terrified by his first meeting with a lion but each succeeding meeting makes the fox less afraid of the king of beasts

Pulling chestnuts out of the fire In *The Monkey and the Cat* by *La Fontaine* the monkey wants to eat some chestnuts that are roasting in a fireplace Not wishing to burn himself he induces the cat to reach into the coals The cat, of course scorches his paw while the monkey eats all the nuts Thus from this fable we also get the expression cat-a-paw meaning a dupe or person who does someone else's disagreeable work

sins so that the guiltiest may be sacrificed and thereby save the rest The lion begins by confessing that he has 'devoured an appalling number of sheep,' even 'the shepherd too' Reynard the Fox then makes an eloquent plea in defense of the king, a plea applauded by the lion's flatterers Finally a poor donkey is sacrificed after he confesses to having eaten grass on the grounds of a monastery The moral of the tale is

Thus do the courts acquit the strong
And doom the weak as
therefore wrong

In America the Negro folk tales collected by Joel Chandler Harris for his *Uncle Remus Stories* are later versions of the fables. In these stories an old Negro gardener tells of the contests of wit between such animals as Brer Rabbit and Brer Fox, in which the helplessness of the rabbit always triumphs over the crafty cunning of the fox

Perhaps the most common modern counterparts of the fable are the animated cartoons and comic strips As in the tale of Reynard the Fox, the moral of these modernized fables is not always apparent, but in them human qualities are transferred to animals which act and speak like human beings We laugh at their foibles and rejoice when innocence or good nature triumphs over brute strength or cunning The delight of children in Walt Disney's 'Mickey Mouse', 'Donald Duck', and 'Dumbo the Elephant' show how deep is the love of the fable

FABRE (*fab'ri*), JEAN HENRI CASIMIR (1823-1915) The great French naturalist, Henri Fabre, was born at St Léon, a village high in the mountains of southern France His grandparents were peasants who could neither read nor write His father, Antoine, wanted

to live in town but could never quite make a living there In trying to do so he moved his family from St Léon to Rodez, from there to Toulouse and then Montpellier He opened a café in each place but always failed a few months later In each new town Henri and his younger brother Frédéric, hunted up a school they could attend After school hours they roamed the countryside together

When Henri was 15 Antoine could no longer support his sons He sent Henri off to earn his own living For a year the boy wandered about southern France, working at odd jobs He never had enough to eat Often he slept outdoors And always he longed to be with

his family At last he came to Avignon where he won a boarding scholarship at the Normal School

After his graduation two years later, Fabre taught in elementary and high schools at Carpentras Ajaccio (Corse), and Avignon He was popular as a teacher, for he made everything interesting He taught himself the sciences, and won university degrees at Montpellier and Toulouse He published reports of his observations on the habits and instincts of insects, and they brought him fame among scholars But he was always underpaid Since he had married at 21 and had five children, he was very poor

At 46 he stopped teaching and supported his family by writing textbooks Presently he bought a small pink washed stone house at Serignan with enough land to provide a garden home for thousands of insects Here he wrote most of his great 10-volume 'Souvenirs entomologiques' From these scholarly but charming studies have come tales of bees, wasps and other small creatures to delight children everywhere



This photograph shows Fabre in his study at Serignan, where he did most of his writing.

Amazing VARIETY of Modern FABRICS

FABRICS. Clothmaking is one of the oldest crafts. Ancient Egyptians wove linen finer than any we make today. The lake dwellers of Europe, a Stone Age people, wove cloth of wool and flax and dyed it with vegetable dyes. Wherever people became civilized, clothmaking developed.

People in different regions made different kinds of cloth. They used the raw materials that were available in their locality. The Egyptians made chiefly linen, the Mesopotamians wool, the people of India cotton, the Chinese silk, and so on (see Textiles). When trade between countries developed, ships and caravans carried different fabrics from one part of the world to another. Knowledge of how to raise and use various raw materials spread.

Ancient people made their fabrics all by hand. Women of primitive households spent long hours spinning and weaving. When people began to live in towns, the steps in clothmaking became separate crafts. One group of workers prepared fiber for spinning, another did the spinning, another the weaving, and another the dyeing. But clothmaking was still a long, tedious process, and cloth was expensive. Only the rich could have as much as they wanted.

Although hand methods improved, the fabrics situation did not change radically for many centuries. Martha Washington would have understood the clothing problems of a medieval household better than she would understand the fabrics problems that confront the modern homemaker.

Cloth Becomes Plentiful

A revolution in ways of making cloth began in the latter part of the 18th century. It was due to the invention of power machinery for spinning and weaving (see Spinning and Weaving; Industrial Revolution). Factories were soon turning out large quantities of cloth. The price came down. Most people could afford to buy enough machine-made cloth to supply all their needs. Clothmaking by hand methods disappeared except as a special craft.

The 20th century brought changes of another sort. Chemists and engineers, working together, created many new kinds of fabrics. Often these were cheaper than the older fabrics. They had different characteristics. Today it is no longer difficult to get enough cloth. The problem is to choose among fabrics of many kinds and qualities.

Understanding Fabrics Today

To understand fabrics, we must know something about the raw materials that go into them. These are

fibers—fine, threadlike substances that can be spun into thread or yarn. The product of spinning is usually called yarn if it is to be made up into cloth, and thread if it is to be used for sewing.

At first all fibers used in clothmaking were natural fibers. That is, they came from animal or vegetable sources. Linen, wool, cotton, and silk are all natural fibers. Today many textile fibers are synthetic, or man-made. Rayon and nylon are examples. Synthetic fibers are among the contributions of modern chemists and engineers to the field of fabrics.

Fibers vary in length, strength, elasticity, heat conductivity, absorbency, luster, and fineness. The characteristics of a fabric depend to a large extent on those of its fibers. The table on page 6 lists the most important textile fibers in use today, together with their distinguishing characteristics.

Less-used natural fibers include jute, hemp, kapok, ramie, sisal, and asbestos. Other synthetic fibers are vinyon, velon, saran, and glass fibers. (See also Fibers; Plastics; and individual entries in the FACT-INDEX.)

Processing Fibers Affects Fabrics

Fibers go through many processes before being spun into yarn. Some of these give the fabric certain characteristics. Carding and combing are examples. The articles on Cotton and Wool explain how machines in modern textile factories carry out these processes. The important thing to consider here is their effect on the finished material.

Carding is a cleaning and partial straightening out of a mass of fibers. It leaves most of the short fibers in the mass. Carded fibers receive a comparatively loose twist during spinning. The resulting yarn, known as carded yarn, is soft and fairly thick. It has a surface fuzz consisting of the protruding ends of many short fibers.

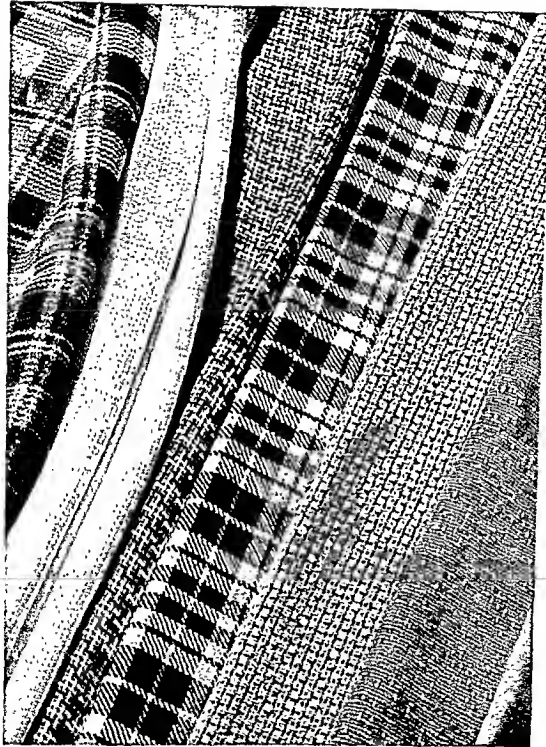
Combing is an additional straightening-out process. It removes the short fibers and lays the long ones parallel. These long fibers receive a tight twist during spinning. Combed yarns, therefore, are smooth, even, and strong.

Muslin sheets show a slight fuzz on the surface. This is because they are woven of carded yarn. Percale sheets, on the other hand, are smooth and fine. The yarn in them is combed yarn. Among other cotton fabrics made of combed yarn are fine organdy, broadcloth, and batiste. Most cheap cotton fabrics are made of carded yarn. Some cotton materials carry a label to show whether they have been made of carded yarn or of combed yarn.

COLOR AND DESIGN IN MODERN WOOLEN FABRICS

In the color plate on the opposite page, the fabric at the left is a plaid tweed woven of homespun yarn. Second, a yellow basket-weave material in which the yarn is fine and smooth. Third, another basket-weave fabric, woven of medium-sized strands in color pairs. Fourth, a black and white plaid cheviot. Cheviot is woven of harder, firmer yarn than tweed. Fifth, a soft, green tweed. In contrast to the first fabric, this tweed suggests how mere alteration in spacing of yarns of different colors can produce an entirely different kind of pattern. Sixth, a nubby tweed woven with threads of unequal thickness. Seventh, a blue wool crepe closely woven with unequal tension on warp and weft.

All these fabrics except the cheviot represent variations of the plain weave. The cheviot is a twill.



Direct-color photograph

See text on opposite page

SOME MODERN WEAVES AND PATTERNS

TEXTILE FIBERS AND THE FABRICS THEY MAKE

FIBER	FABRIC	BURNING TEST FOR IDENTIFICATION
<p>Cotton: Vegetable; $\frac{3}{8}$-2 in. long; flat, with spiral turn; rough surface; finer than linen or wool; stronger than rayon or wool; good heat conductor; not absorbent; not elastic; not injured by alkalis.</p> <p>Flax: Vegetable; 12-40 in. long; coarsest next to wool, next in strength to silk; cylindrical, with nodes; lustrous; good heat conductor; very absorbent; least elastic; not injured by alkalis.</p> <p>Silk: Animal; about 400-1,000 yd. long; double-cylindrical filament; finest, strongest, most lustrous natural fiber; nonconductor of heat; more absorbent than linen; next to wool in elasticity; harmed by alkalis.</p> <p>Wool: Animal; about 1-14 in. long; cylindrical, scaly; coarsest; weakest; nonconductor of heat; most absorbent; most elastic natural fiber; easily harmed by alkalis.</p> <p>Rayon: Man-made, from cellulose; continuous filament and staple fibers; diameter varies; $\frac{1}{4}$-$\frac{1}{2}$ the strength of silk when dry; weaker when wet; inelastic except in spun yarn; viscose rayon a good heat conductor, very absorbent, not harmed by alkalis; acetate rayon a nonconductor, nonabsorbent, injured by alkalis.</p> <p>Nylon: Synthetic organic fiber; continuous filament and staple fibers; diameter varies; stronger, more elastic than natural fibers; light weight; resists abrasion; least absorbent; can be permanently shaped by heat.</p>	<p>Cotton: Usually soft and smooth; strength depends on yarn and weave; dull unless mercerized; cool; clammy when wet; dries quickly; without affinity for dyes but can be made colorfast; wrinkles easily; can stand strong soap; mildews.</p> <p>Linen: Strong; durable; lustrous; cool, absorbs moisture readily, and dries with cooling effect; least affinity for dyes; wrinkles very easily; can stand strong soap; subject to mildew.</p> <p>Silk: Strong; lustrous; warm; absorbs and holds moisture without feeling wet; takes dye well; drapes successfully; resists crushing; injured by strong soap; may require dry cleaning.</p> <p>Wool: Soft or firm, depending on yarn and weave; dull surface; very warm; extremely absorbent without feeling wet; weaker when wet; highest affinity for dyes; resilient, holds a press; usually requires dry cleaning.</p> <p>Rayon: Filament yarns usually make lustrous, cool fabrics; spun yarns, dull, warm, crush-resistant fabrics.</p> <p>Viscose rayon cool; absorbs moisture like silk; not harmed by strong soaps; mildews.</p> <p>Acetate rayon warm; resistant to moisture; requires care in washing; melts if ironed at high heat.</p> <p>Nylon: Smooth; strong; resists "wear and tear"; resilient; requires special dyeing; easily washed; does not shrink or stretch; dries rapidly; needs little ironing; resists heat, attacks by mildew, molds, and insects, as well as action of alkalis, grease, oil, sunlight, and salt water.</p>	<p>Cotton: Burns quickly with yellow flame; odor like burning paper; feathery gray ash; if mercerized, black ash.</p> <p>Linen: Burns quickly with yellow flame; odor like burning paper; light ash.</p> <p>Silk: Pure dye silk burns slowly with hairlike odor, leaves crisp black ash; weighted silk chars, does not flame, leaves ash in shape of burned sample.</p> <p>Wool: Burns with flickering, sizzling flame; does not smolder; strong animal odor; irregular, crisp black ash.</p> <p>Rayon: Viscose rayon burns like cotton. Acetate rayon flares, sputters, and melts; odor like vinegar; brittle black ash.</p> <p>Nylon: Undyed, unfinished nylon is flameproof; melts at 450°F. if a flame is applied; materials added in finishing may flame.</p>

This table shows how the characteristics of fibers help to determine the qualities of fabrics. Long fibers make strong yarns, and these make strong cloth. Smooth fibers mean lustrous fabrics. Fibers that conduct heat make cool fabrics. If alkalis do not injure the fibers, the fabric can stand strong soap. Elastic fibers make resilient, crush-resistant cloth.

Carded wool yarn makes soft, warm, resilient woolen cloth. In contrast, combed wool yarn makes worsted, a smooth, strong cloth. Flax fibers, the raw material of linen, are combed but not carded (see Linen).

Carding and combing produce long, ropelike lengths of fiber masses called slivers. These go through several drawing-out processes until they are pencil thin and lightly twisted. Then they are known as rovings. Rovings wound on bobbins go to spinning machines. There they receive a final drawing out and twisting. Fibers leave spinning machines as yarn or thread of any desired size and twist.

Softly twisted yarns make fabrics with a soft surface. More firmly twisted yarns make firm, smooth fabrics with some elasticity and resistance to wrinkling. The yarns that go into crepes are very tightly twisted; in the same fabric, some may have a right-hand twist and some a left-hand twist.

Yarns of different weights woven together produce novelty effects, such as "nubby" weaves. Several strands of yarn twisted as one form ply yarns. Fab-

rics woven of ply yarns are especially durable. Duck and good broadcloth shirting are examples.

Filaments Are Very Long Fibers

Most natural fibers grow to characteristic lengths. This is true of cotton, linen, and wool. Some fibers, however, are produced by processes that can make a long, almost endless strand. These are called filaments, from the Latin verb *filare*, "to spin." The silkworm spins filaments of silk to make its cocoon, ejecting a gummy substance through two tiny, tubelike openings in its lower jaw (see Silk). The apparatus for making synthetic fibers imitates this process. It pumps a thick chemical solution through holes in a spinneret, a device that looks like a miniature shower bath nozzle. The streams of solution solidify into filaments in the air or in a liquid bath. The diameter of the holes in the spinneret varies according to the size filaments the manufacturer wants to make (see Rayon; Nylon).

Silk and synthetic filaments are usually thrown, or twisted, to make yarns with many filaments. The

yarns are smooth, without protruding ends to make fuzz. Because they are smooth, they are lustrous. They can, however, be "delustered."

Filaments may be cut into lengths similar to those of cotton, wool, or flax fibers. Then they are spun into yarns on machines like the ones used for spinning these natural fibers. The yarns that result are called spun yarns.

Manufacturers make spun silk yarns chiefly to use up broken filaments and other waste. Spun silk is not so strong or so elastic as yarn made of reeled silk filaments. Nevertheless it makes attractive fabrics including tub silk.

Spun yarns serve a different purpose with synthetic filaments. They add to the variety of fabrics that can be made from these fibers. Manufacturers make spun rayon and spun nylon yarns into materials that resemble linen, wool, and cotton rather than silk.

The short lengths of rayon and nylon filaments are called staple fibers. Manufacturers can blend them with each other or with natural fibers. Thus they can combine desirable features of two or more fibers in one spun yarn.

Weaving Yarns into Fabrics

Weaving is an interlacing of yarns or other fibers at right angles. Fabrics are woven on looms. These have developed from a simple, warp-weighted type used by Stone Age people to power looms so complicated that only an experienced eye can follow their movements.

(see Spinning and Weaving) But the principle in all looms is the same. A frame holds a set of lengthwise yarns. These form the warp. A shuttle carries a weft yarn through the warp yarns, back and forth, to fill out the fabric. (Weft yarns are also known as wool yarns or filling yarns.)

Harnesses with attachments to individual warp yarns raise and lower different sets of these for each passage of the filling yarn. The grouping of warp yarns as the harnesses raise and lower them determines the pattern of weaving. There are three basic weaves—plain, twill and satin.

In a plain weave, the filling yarn passes under one warp yarn and over the next. Every other row is alike. Any lines that are visible run straight across or straight up and down the cloth. Percale, taffets and organdy are examples of the plain weave. They differ from one another because the yarns in them are different. Basket weave is a variation of the plain weave in which two or more filling yarns pass together over and under similar groups of warp yarns. Rib weaves are also variations of the plain weave.

In the twill weave, filling yarn passes over and under groups of warp yarns in such a way as to make diagonal lines across the surface of the fabric. Thus

weave appears in cheviot, herringbone, covert cloth, serge, gabardine, denim and drill and in some tweeds and flannels. It makes strong, firm cloth.

In the satin weave, filling yarn passes under the warp yarns at widely separated intervals. In a variation called the sateen weave, the filling yarn passes over the warp yarns at similar intervals. In the first case, warp yarns "float" on the surface, in the second case, filling yarns "float." In both cases the surface is lustrous (if a smooth yarn is used) because the floating yarn, lying nearly continuously on the surface of the fabric, catches and reflects light.

How Weaves Are Combined

A manufacturer can put designs into cloth by combining two or more basic weaves. He may do this by attaching a "dobby head" to an ordinary loom. A dobbie is a chain mechanism to control the raising and lowering of as many as 25 harnesses for one weaving. It makes possible the weaving in of small, regular designs. In an over-all diamond pattern, for example, the background might be plain weave and the diamonds done in satin weave. Hucksback toweling and bird's-eye are woven on a loom with a dobbie attachment.

For a large and complicated design, the manufacturer uses a Jacquard loom. This has a perforated card mechanism which operates on somewhat the same principle as a player piano. It controls the

warp yarns individually, raising and lowering them according to the holes in the cards. (For picture, see Rugs and Carpets.) The Jacquard loom produces such fabrics as matelassé, damask and brocade.

In pile weaving, the loom may carry an

extra set of warp yarns. These are thrown to the surface, usually over wires, to form loops. If the wires have blades at the ends these cut the loops as the wires are withdrawn, making a "cut pile." Examples of cut pile fabrics are velvet, plush, and most rugs and carpets. Brussels carpets have an uncut pile.

The pile of corduroy and velveteen is produced with an extra set of filling yarns. These float on the surface as in the sateen weave. The fabric leaves the loom as a flat material. Then a cutting machine cuts the floating yarns midway between their intersections with the warp yarns and they stand up as pile.

By varying the basic weaves and by combining them, and by using the many textile fibers in the various weaves, manufacturers can produce hundreds of different fabrics. It would be impossible to tell about all of them here. The most important ones have descriptive entries in the FACT-INDEX.

Knit Fabrics Have "Stretch"

Knitting is an interlooping of one yarn or a set of yarns to form a fabric. It contributes flexibility,

ALL WEAVES ARE VARIATIONS OF THESE



From left to right, these diagrams show the plain, twill, and satin weaves. The text tells how they are done, and how they are varied and combined.

elasticity, and warmth. There are two types of knit fabrics: weft knit (also called filling knit) and warp knit. Both are done on flat-bed machines to form flat fabrics and on circular machines to form tubular fabrics (see Knitting Machines).

Weft knit, done with one yarn, has three basic stitches—plain, purl, and rib. Plain-knit fabrics show chainlike rows of stitches running lengthwise on the face, and crosswise ridges on the back. They have considerable crosswise elasticity. Balbriggan and jersey are examples.

Purl-knit fabrics have crosswise ridges on both sides. They are elastic in both directions, but more so lengthwise. Rib knit combines plain and purl stitch to create groups of lengthwise ridges, or wales, alternately on the two sides of the fabric. This type of knitting produces the most elastic fabric.

Warp knitting, done with many yarns, makes great variety in construction and design possible in knit fabrics. Lengthwise rows of loops characterize the type. Well-known examples are tricot and milanese. Tricot looks like plain-stitch weft knitting. For this reason it is sometimes called jersey. Milanese has a fine, diagonal, twill-like rib. Its elasticity lies in the direction of the ribs. Warp-knit fabrics are stronger, firmer, and more run-resistant than weft-knit, but they are less elastic.

Other Ways of Making Fabrics

Though we usually think of cloth as either woven or knit, there are other ways of making fabrics. *Felting* is a matting together of fibers by means of moisture, heat, and pressure (see Felt). *Braiding* is an interlacing of three or more strands of yarn or other fiber so that each strand passes over and under one or more of the other strands. Braid may be flat or round. Manufacturers use all the textile fibers, as well as metal, tinsel, straw, wire, and leather in braids. They use the braids to make hats of straw or other fiber, small rugs, dress accessories, and many other articles. *Netting* is an intertwining of yarns at each point where they cross, so that they form a mesh type of fabric. Netted fabrics vary from a coarse open, fish-net type to fine hand-made or machine-made lace (see Lace).

The chemist and engineer have used their modern magic to produce fabriclike plastics. We can hardly call these cloth. They are not made by any of the cloth-making processes. Yet they serve many of the

uses of cloth. Like all plastics, they are molded. They are waterproof and dustproof. Some are chemical resistant. They appear as "yardgoods," and in draperies, shower curtains, upholstery, raincoats, dust covers for dishes and kitchen appliances, and clothes bags. They have many trade names, including plicofilm, krene, elasti-glass, and vinylite (see Plastics; Rubber).

Another type of material that is not quite cloth is made of rayon fibers pressed and rolled into thin sheeting. Cellulose is included with the fibers as

binding to hold them together. This material is sold in rolls as cleaning, dusting, and polishing cloth.

Finishes for Beauty and Service

When cloth leaves the loom or the knitting machine, it is not the attractive fabric we see in finished goods. Either before or after it is dyed it goes through various finishing processes. Some of these increase its beauty or durability. Others fit the cloth for special purposes. Some are very old. Fulling and napping, for example, were done in ancient Rome. Others require modern machines and modern knowledge of chemistry. Some important finishing processes are:

Singeing: Rapid passing of fabrics over gas flame or hot plates to burn off lint, threads, fuzz and fiber ends; done to all fabrics made of short-fiber yarns.

Mercerizing: Chemical treatment which adds luster, strength, and absorbency to cotton goods (see Mercerizing).

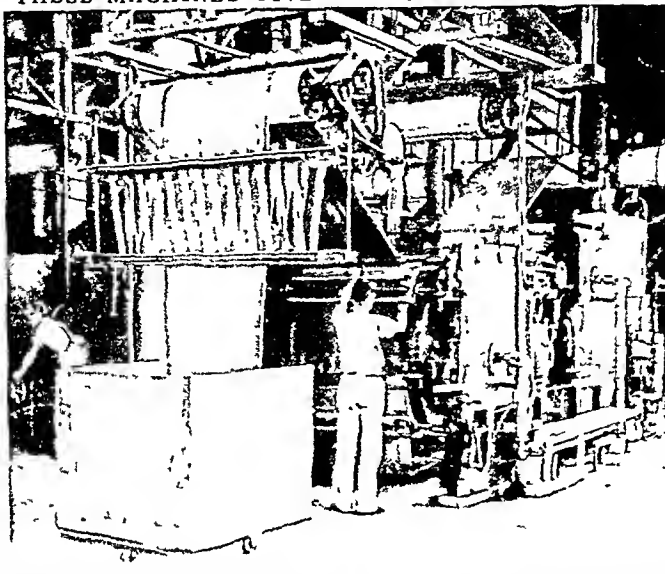
Bleaching: Removal of natural color, usually by chemicals. Bleaching makes white goods whiter and prepares cloth for printing; tends to weaken fabrics somewhat.

Preshrinking: Returning to their original shape of fibers that have been stretched by tension on yarns during weaving. Soaking in cold or hot water, use of steam, and chemical treatment are some of the methods used. Fabrics may shrink more later.

Fulling: Cleaning, scouring, and compressing wool. The Romans trod on woollens in tubs containing water and fuller's earth; modern methods include use of cold or hot water, soap, chemicals, and hydraulic pressure.

Enterprising: Lining up of a fabric that has pulled out of shape. A roller feeds damp cloth to a machine which has clamps (enterhooks) that grip the selvages and then jerk the cloth into shape.

THESE MACHINES GIVE A "SANFORIZED" FINISH



"Sanforized" indicates a patented mechanical process that limits later shrinking to less than one per cent. A test piece of fabric is measured, washed, and measured again. This shows how much the cloth will shrink. Then the fabric is dampened and passed over rollers set to compress it to the exact size indicated by shrinkage of the test piece.

Sizing Stretching to provide body and weight. In permanent sizing a chemical treatment changes the fiber's cellular structure and gives permanent stiffness.

Glazing Use of starch, glue, mucilage or shellac to produce a high polish. Synthetic resins give a permanent glaze.

Calendering Ironing fabrics by passing them through heavy polished heated rollers moving at different speeds.

Napping Brushing up a fuzz on cloth made of lightly twisted yarns. The Romans used vegetable burs called fuller's teasels. Modern manufacturers use teasels for fine fabrics and wire brushes for less expensive fabrics.

Anterush Finishing Impregnation of linen or cotton yarns with synthetic resins to give elasticity makes fabrics crush resistant.

Waterproofing Coating with rubber or plastic compound use of synthetic resins or waxes makes fabrics water repellent.

Putting Color into Fabrics

Dyeing gives color to cloth by immersing one of the fiber, yarn or fabric in a solution of dyestuffs (see Dyes). Stock dyeing or dyeing at the fiber stage and yarn dyeing produce yarns for plaids, stripes and other designs worked out in different-colored yarns. If a fabric is solid color it was probably piece dyed. This means dyeing of the completed fabric. It is the most economical method.

Printing in contrast to dyeing applies dyes in precise form to produce a color effect on the surface of fabric. In block printing a craftsman carves the design on a wood or metal block. He applies paste dye to the block. Then he presses the block down on the fabric. Each color requires a separate block. In screen printing workers use lacquer to block out all but the design on a copper or fabric screen. Then they force color paste through the design onto the fabric. They use a different screen for each color.

Roller printing is a machine process and can print thousands of yards in a short time. The design is engraved on copper rollers with a separate roller for each color. Workmen feed the fabric through the rollers which print the design on the fabric in much the way a printing press prints on paper.

Photographic printing of fabrics is done by sensitizing fabrics with photographic compounds and exposing them to light under a design negative. Developing the fabric makes a single-color design in all gradations of that color.

Definitions for the Buyer

A person buying fabrics and articles that are made of fabrics encounters several terms that need understanding.

The cloth count, also called the thread count, is a measure of the closeness of weave. It indicates the number of warp and filling yarns to the square inch. A standard percale sheet has a count of 96×84 (96 warp and 84 filling yarns). It is called type 180 (the sum of warp and filling counts). A heavy muslin sheet, type 140, has a count of 74×66. Cloth count is a factor in durability, but so is size of the yarn. The muslin sheet will probably outwear the percale. The cloth count is lower, but only because the yarn is heavier, the weave is firm. The percale, since it is finer and smoother, is pleasanter to the touch.

And it will outwear a muslin sheet with a lower cloth count than that of type 140.

In modern fabrics the cloth count ranges from 20×12 in the coarsest cheesecloth to 160×165 in fabric for the finer typewriter ribbons. The Egyptians made linen mummy cloths with 540 warp yarns to the inch. No modern manufacturer would make yarn fine enough for such weaving, even if a weaver would use it.

A high cloth count and heavy yarn do not mean a warm fabric. Fabric that has air spaces is warm because the air spaces provide insulation. Cloth loosely woven of soft yarn has more air spaces than firm, tightly woven cloth. Thus it is warmer. Napping adds to warmth by creating air pockets.

The term gauge has a significance similar to that of cloth count but refers to knitted fabrics. It is important to the buyer chiefly in connection with hosiery. It indicates the number of stitches in each 1½ inches. The gauge in women's full-fashioned nylon stockings varies from 45 to 67, the fineness of knit increasing as the number rises.

Denier (*de-ni-er*) is an expression of the size of filament yarns. A denier is a weight of 5 centigrams. The number of deniers required to weigh a skein of yarn 450 centimeters long indicates the size of the yarn. One denier yarn is extremely fine. Average human hair is about 50 denier. Rayon yarns for

SCREEN PRINTING FINE FABRIC



These workers are applying color paste through a screen on which they have blocked out all except the parts of the design calling for that color.

dress fabrics are usually 100 to 150 denier. In rayon fabrics called multifilament the denier is 2½ to 3. These fabrics are very sheer.

Single filament nylon yarn is 15 denier. Multifilament nylon yarns range from 20 to 210 denier, averaging 30 to 40. Women's nylon stockings vary from 15 denier, which is very sheer, to 50 denier or higher in service weight.

FACTORIES AND FACTORY LAWS. A billion slaves toiling every day from sunrise to sunset, using the spinning wheels and hand looms of 200 years ago, could not make as much cloth in a year as great textile factories now make in a week. This is the estimate which a careful historian gives of the enormous increase in man's productive power through the invention of machinery and through the organization of the present-day factory system of manufacturing.

Factories started in ancient times, but until the 18th century they were few and virtually all factory work was done by hand. Then the development of steam power and machinery in England brought the modern factory (see Industrial Revolution). In place of hand tools that had been used for hundreds of years, workmen now use vast and complicated machines, driven by water power, steam power, or electricity. Instead of a single workman making an entire pair of shoes, the process is so subdivided that 250 persons take part in its production.

The English at first guarded the secrets of their inventions. They did not permit machines to be shipped from England and even forbade anyone to send plans abroad. For this and other reasons, the factory system developed later in other countries than in Great Britain. But in 1789 Samuel Slater, a young English workman, came to the United States and from memory drew the plans for a cotton mill in Rhode Island and supervised its construction (see Rhode Island). It was not until 30 years later that the factory system began to develop in France, Germany, and other European countries. Today the United States leads the world in quantity of manufactured goods, although other countries may lead in quality of certain selected products.

Locating and Building a New Factory

When a company plans to build a new factory, it studies available locations for industrial advantages. For example, the site must be reasonably near both sources of raw materials and markets for the finished products. Transportation facilities must be convenient. Most industries prefer rail transport, but such heavy raw materials as iron ore and coal can be shipped cheaply by water. Good highways for trucks are also desirable. Industries which use much electric power try to locate where power is cheap.

The company studies the whole community to learn the extent of taxes and legal restrictions and if workers with the necessary skills live there. Many communities that want to attract new factories make sure that their laws will not hinder industrial settlement and growth. Factories that employ most of their workers for only part of the year may seek a rural community where workers can farm during off months. The company looks too for ample land to permit automobile parking and future expansion of the plant. Many companies avoid crowded factory districts and build on the outskirts of a town.

The architects plan the factory building so that materials flow quickly to the workers to enable them to do their jobs efficiently. Before the architects

even draw plans, they study the company's manufacturing problems and then consult with company engineers and production managers to get maximum efficiency. The architects also consider the problem of adding more stories to the building at some future time. Then, too, the company may modify its operations in the future. That means that the architects must plan the factory for "adaptability of space," such as removing or adding walls, shifting machinery, or changing office arrangements. They must also provide adequate light and keep machine noise to a desirable low level. Plans for a large factory usually include such items for the workers as locker rooms, a cafeteria or canteen, and first-aid quarters.

Men and Their Machines

The man in charge of manufacturing is usually familiar with every phase of his factory's operation. In recent years, in many large companies, he is a college graduate and has had training experience at varied jobs in the plant. Under him, in supervisory capacities, are men who have the same education and practical experience. Then come department managers, each qualified in the work of his own section.

Workers are generally divided into skilled, semi-skilled, and unskilled groups. The first are men who usually have a high-school and trade-school education. They have served an apprenticeship, and their years of experience qualify them for the most precise and difficult work. They usually command higher wages than men of equivalent education and experience in office jobs. Semiskilled workers have some manual dexterity and enough experience to perform rather complex tasks. They often graduate to the skilled group. Unskilled workers fill the jobs that can be learned in a few hours or days. Any of these groups may provide men who may rise to the highest administrative posts.

Many factories offer "on-the-job" training or co-operate with community schools in teaching needed skills. Young men who show promise may be placed in special apprentice courses where they can get a broad knowledge of operations and work into the field which suits them best. Other workers attend evening schools to fit themselves for higher positions.

Maximum efficiency is sought in factory operations. This does not mean complete mechanization. Men are always needed to test raw materials and finished products, to control machines, to repair them, and to exercise the judgment and decision that cannot be built into a machine.

Laws to Protect Workers

The history of industry is marked by increasing legislation to protect the health and safety of the worker, to provide him at least a minimum wage, and to offer him a measure of security against loss of his job. The growth of labor unions and their direct relations both with factory management and with law-making bodies has done much to promote the welfare of the workers. Special state laws govern the working hours and conditions of women and children. (See also Child Labor Laws; Industry, American; Labor.)

FAIRIES "Do you believe in fairies?" asks Peter Pan of the audience in the fourth act of Barrie's charming play. In the faces of young and old there is the same answer, for so real do the fairies seem that for the moment we all believe in them. If we can almost believe in fairies today we need not wonder that people of earlier times, who did not have science to explain the strange and wonderful things of the world, felt so certain of the existence of such supernatural beings.

Fairies were supposed to be of almost any size or appearance, and many of them had the power to transform themselves into the shapes of animals. Most often imagination pictured them with the form of human beings, but very, very small—a few inches high, airy and almost transparent in body so delicate in their form that a dew-drop, when they chance to dance on it, trembles, indeed, but never breaks."

Related to the fairies are the *gnomes* or *leobolds*,

ugly little creatures who live underground and guard the earth's stores of jewels and precious metals, the frolicsome *elves*, the *brownies*, who love mischief but will perform many helpful tasks for the family that is kind to them, the *kelpsies* and *maries* who are water fairies and lure men to their death in the depths of beautiful streams and the *trolls*, who are familiar and friendly, but often mischievous, dwarfs. There are good fairies and bad fairies, but most of these little people are kind to those who do right and who are good to them, and punish those who are wicked or who offend them.

We find fairies in the folklore of almost all peoples. Some of the most beautiful and fanciful of our fairy tales come from Ireland, and in many parts of that land the country folk still believe in "the good people," as they call these little sprites. In English folklore Oberon is represented as the king of the fairies, and Titania as their queen.

From MEDIEVAL FAIRS to Giant EXPOSITIONS



Treasure Island, in San Francisco Bay, Was the Site of the Golden Gate Exposition in 1939-40

FAIRS AND EXPOSITIONS In ancient and medieval times most people lived on isolated farms or estates where they produced almost everything they needed. Their lives, for the most part, were lonely and monotonous. But once or perhaps twice a year they had a chance to attend a fair in a near-by town, and for those who could go it was an event to be long remembered. From a radius of perhaps a hundred miles people came to trade and to enjoy themselves.

Fairs still have an important place in the pageant of commerce. From time to time great international fairs and expositions are held to dramatize the march of industry and science. Numerous smaller exhibits are planned every year by single industries. Most of these special shows are for wholesale buyers, but to some of them—such as automobile shows, boat shows, and fashion shows—the public is invited. Every year too hundreds of agricultural fairs are held. When the harvest is over, the farmer and his family drive off to the county or the state fair, taking with them their finest live stock and samples of their best produce, hoping for a prize.

Entertainment plays an important part in the modern fair as it did in the old. But the industrial fairs of today are sample shows rather than markets. The visitor looks over the new merchandise and compares the offerings of the various manufacturers. When he is ready to buy, mass production assures him that his purchase will be identical with the sample shown.

Fairs in the Middle Ages

The great annual fairs of the Middle Ages were usually opened on the day of an important church festival. Bells pealed gaily forth from the cathedral, banners fluttered from buildings, and the city bustled with trade and boisterous celebration. Noblemen and their ladies, knights, peasants, and townspeople thronged the narrow streets. Jugglers and tumblers performed their feats of skill, minstrels sang their lays, and Punch and Judy puppets went through their antics.

Sharp-eyed merchants presided over stalls filled with woolen cloth from Flanders, costly spices and silks from the Orient, wine from Gascony, tar from Norway, and amber and furs from northern Germany.

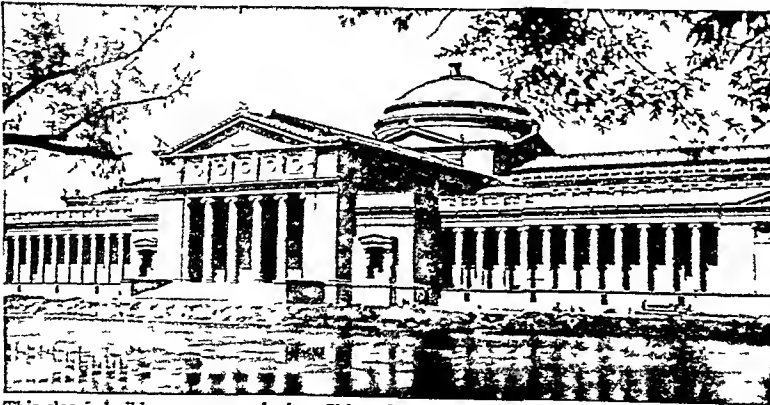
and Russia. The guilds too offered their wares for sale (see Guilds). For a week or longer the buying and selling, the dancing and merry-making, went on. Then the merchant packed up his wares and moved on to another fair, the peasant trudged to his home, and the lord and lady rode back to their castle with their silks and spices and furs.

Fairs spread rapidly throughout western Europe as trade expanded in the Middle Ages (see Trade; Crusades). Merchant caravans, pushing through from the Orient and the Baltic, wanted an outlet for their stocks. Towns were far apart and had but few shops. These shops, moreover, commonly sold only goods made in the town, because of guild restrictions. Only at fairs were foreign merchants permitted to sell at retail.

Only certain cities had the right to hold a fair. The privilege was granted in a license to the lord of the city by his overlord or by the king. Each favored city held its fair at the same time each year so that traveling merchants might arrange far in advance to be there. Merchants were required to pay fees to the lord who held the fair license. In exchange they received privileges, such as the right to buy and sell among themselves as well as at retail. They also gained the right to have their disputes settled immediately. The fair's court was called the "court of Piepowder" from the French words, *pieu poudreux* (dusty foot), symbol of the traveler. The court ruled on price disputes and contracts and on complaints of thievery and disorder. Sometimes it sentenced men to die on the gallows.

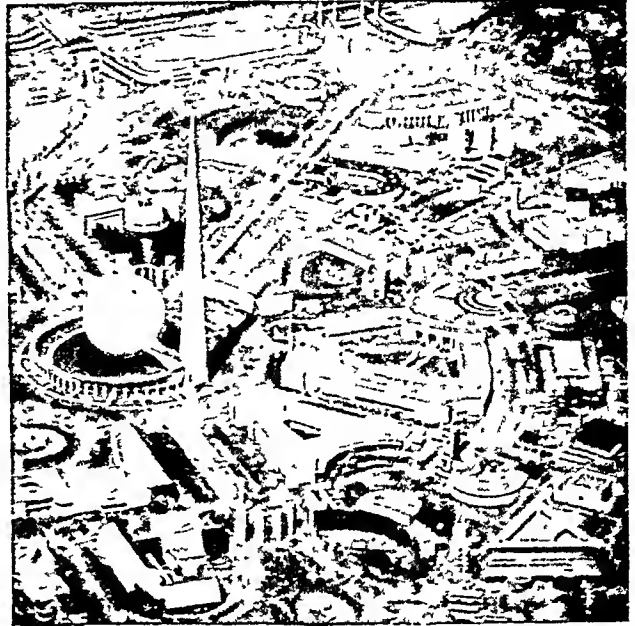
Medieval fairs played a significant role in the advancement of commerce. They encouraged trade with the Orient and with eastern and northern Europe. By giving merchants the right to trade among themselves, they also stimulated the development of wholesale trade and the use of credit. Their customs and laws furnished the basis for modern commercial law.

MEMORIAL OF THE COLUMBIAN EXPOSITION



This classic building was spared when Chicago's "White City" of 1893 was demolished. Later it was restored to house the Museum of Science and Industry.

A GLIMPSE OF THE "WORLD OF TOMORROW"



The great New York fair of 1939-40 dramatized science as well as industry. The 200-foot sphere and tall pointed pillar symbolized the "World of Tomorrow." Marshes in Flushing were filled in to provide the site.

But the fair was more than a clearinghouse for merchandise. Ideas were exchanged too. Imported wares inspired the local artisans to improve their products, and isolated communities learned about foreign ways from traveling merchants.

Among the more famous medieval fairs were those of St. Bartholomew at Smithfield (just outside London); Stourbridge, also in England; Ferrara in Italy; Leipzig and Frankfurt-on-the-Main in Germany; and Troyes in France (which gave its name to our system of troy weights). The trade fair still survives in countries where commerce is primitive, as at Mecca in Arabia and at Hardwar in northern India. The great fair at Nizhni-Novgorod (Gorki) in Russia, which used

to draw 200,000 visitors, was not abolished until 1930.

The gradual increase of town shops and markets in the 17th century led to the rise of the wholesale fair, where retailers bought stocks for their stores. In the 19th century mass production and the speeding up of transportation and communication made it possible to fill orders quickly, and the fair merchants began to limit their displays to samples. In the 20th century many European cities built huge permanent fair buildings where the samples of many manufac-

BRIEF REBIRTH OF FORT DEARBORN



Chicago's Century of Progress Exposition in 1933-34 temporarily reproduced the fort which had sheltered the first settlers a hundred years before. The arched structure was the powder magazine and at the right the commander's quarters.

turers could be displayed. Some of these modern fairs, such as that at Leipzig, Germany, developed from fairs founded in the Middle Ages (see Leipzig). In the United States it is customary to hold shows organized by the manufacturers' association of a single industry. In Canada the Great National Exposition holds annual manufacturers' displays at Toronto.

International Fairs and Expositions

The first international exposition was held in London in 1851, sponsored by Prince Albert. A vast structure of iron and glass called the Crystal Palace was erected in Hyde Park to house it. The Great Exhibition was a tremendous financial success and it brought indirect benefits as well. The English people saw the arts and crafts of other countries, and foreign visitors could examine English machine-made goods. The next decades saw a flood of international expositions all over the Western World, usually on the anniversary of some historical event. Instead of a simple display of products, industrial processes were shown, with machines in action in miniature factories.

Architects were free to use bold new designs for the temporary fair buildings. Beautiful "exposition cities" were created that influenced building designs and city planning. Governments and industries paid for the buildings to house their exhibits, and the expositions grew in size and splendor. Many of these giant shows failed to meet expenses in spite of the huge gate receipts and the selling of hundreds of concessions.

Some of the Most Famous Expositions

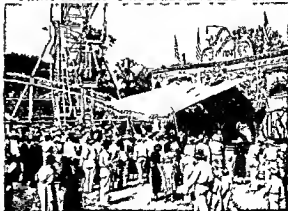
- The following list includes the modern expositions best known to the English-speaking world:
- 1851 The Great Exhibition, London, Crystal Palace built
 - 1873 International Exhibition Vienna
 - 1876 Centennial Exhibition, Philadelphia, Pa., 100th anniversary of the Declaration of Independence
 - 1889 Universal Exposition, Paris, centenary of the French Revolution, Eiffel Tower built

- 1893 World's Columbian Exposition Chicago, Ill., fourth centenary of discovery of America
- 1901 Pan American Exposition Buffalo, N. Y.
- 1901-2 South Carolina Interstate and West Indian Exposition Charleston, S. C.
- 1904 Louisiana Purchase Exposition St. Louis, Mo.
- 1905 Lewis and Clark Centennial Exposition, Portland, Ore.
- 1909 Alaska Yukon Pacific Exposition Seattle, Wash.
- 1915 Panama Pacific Exposition, San Francisco, Calif., celebrated opening of the Panama Canal
- 1915-16 Panama-California Exposition San Diego, Calif.
- 1924 British Empire Exhibition Wembley, England
- 1926 Sesqui-Centennial Exposition Philadelphia, Pa.
- 1933-34 Century of Progress, Chicago, Ill.
- 1935 California-Pacific International Exposition, San Diego, Calif.
- 1936-37 Great Lakes Exposition Cleveland, Ohio
- 1936-37 Centennial Central Exposition Dallas, Tex.
- 1939-40 New York World's Fair (World of Tomorrow) New York City
- 1939-40 Golden Gate Exposition, San Francisco, Calif.
- 1951 Festival of Britain, London

State and County Fairs

The agricultural fair is popular in all countries of the Western World. In the 18th and 19th centuries agricultural clubs were formed in Europe and America to promote better farm methods and improve livestock. Prizes were offered for the best farm produce and livestock. Races and entertainments attracted visitors and helped pay for the prizes. The first real agricultural fair in the United States was organized in 1810 by the Berkshire Agricultural Society of Pittsfield, Mass., under the direction of Elkanah Watson, "the father of American fairs." In 1819 the New York legislature made an appropriation for county fairs, and other states soon followed. The International Livestock Exposition, held annually in Chicago, is an agricultural fair on a vast scale. The agricultural fairs held in the United States today range in size from small county fairs to large state and interstate exhibits.

FARM FAMILIES AT THEIR STATE FAIR



This view of the fairgrounds at Topeka, Kan., shows visitors taking in the side shows. The state fair combines amusement and education.

The state fair usually has permanent buildings and extensive grounds. At fair time it resembles an amusement park. Barkers shout the merits of their entertainments and vendors sell spun-sugar candy and ice-cream cones. In the background, occupying many blocks, are the farm exhibits—cattle and massive work horses in neat stalls, and grains, fruits, and vegetables arranged in attractive displays.

The fair lasts a week or longer, and many families come to stay for the entire period, living in trailers, tents, or dormitories. Every day has its special program—draft horses in pulling contests, horse racing, livestock judging, or demonstrations of cooking. Livestock growers and farmers enter their finest animals and samples of their best crops in the hope of receiving a money prize and a cherished blue ribbon. Through their 4-H Clubs, boys and girls take part in the contests at these and other fairs (see 4-H Clubs). The state university usually contributes exhibits, and its staff lectures on agricultural topics.

State fairs are organized by fair associations and are supported by government appropriations, gate receipts, and the fees from amusement concessions.

Some agricultural fairs are devoted to a single product. Lexington, Ky., for example, holds an annual tobacco fair. Other places dedicate fairs to cotton, rice, sugar cane, corn, potatoes, yams, pumpkins, melons, alfalfa, peanuts, wine, and turkeys. These fairs are usually in the nature of carnivals. Like the county and state fairs, they have the grower in mind; but they have also a secondary aim, which is to advertise the local product. Fairs of this sort are sponsored as a rule by farm co-operatives.

FALCONRY. Winging high over an open field at dusk, a heron is returning to its nest. In its long sharp beak is a small fish. Crouched in a thicket a falconer (hunter) is waiting silently. Deftly he unhoods the gyrfalcon which is perched on his gauntleted hand, whistles softly, and releases it. With lightning speed the falcon flies at the heron. The heron flutters its wings, drops the fish and soars higher and higher into the air. The falcon, flying in wider spirals, but at greater speed, climbs above the heron, then

THE SWIFT AND POWERFUL PEREGRINE FALCON



The tremendous speed, strength, and daring of the peregrine falcon, or duck hawk, make it a favorite for training in the sport of falconry. This high-speed photograph by Gjon Mili shows a bird just taking off from the falconer's wrist. The leg straps are called

"jesses." They serve the same purpose as a dog's collar. The bells help to locate the bird wherever it may alight. Peregrine falcons have a cruising speed of 60 miles an hour and dive at more than 150 miles an hour. They feed chiefly on shore birds and waterfowl.

swoops downward like a flash of winged lightning. Within a few feet of its quarry it closes back its wings and darts on the heron, striking it with a fierce blow. The two then come to earth together at a tremendous speed and the falconer, rushing forward, seizes the heron by the neck.

This sport in the Middle Ages was the favorite pastime of the nobility. The sport was revived in the 18th century, but shooting became more popular, and falconry never regained its old prominence. It continued, however, to be practised without interruption in various parts of Asia and Africa, and has in late years been revived in England and the United States. The sport appears to have been known in China as early as 2000 B.C. Other ancient records of falconry are found in Japan, India, Arabia, Iran (Persia), Syria, and northern Africa.

Training Birds for Hawking

Training birds for hawking is an art. The falcon may be taken from the nest before it has learned to fly, when it is called an *eyes* or *eyeser*, or it may be trapped full-grown and tamed. It is then called a *haggard* or *blue hawk*. A hood is used in taming to cover the falcon's head and a *brai*, or strip of leather, is slipped over the wings to prevent fluttering. *Jesses*, or strips of light leather with bells attached, are fitted to the legs. A leash is fastened to the jesses.

The bird is kept in a dark room for perhaps 72 hours. Always there is someone in the room, smoking a pipe or cigars or cigarettes to remind the bird of man's presence. The smoke also seems to calm the bird. Then the falcon is "developed like a picture." First a small candle is lighted. Then the room is gradually made brighter so that the bird becomes accustomed to his surroundings slowly. After a while it learns to feed from the hand and loses its fear of its new master. This training requires great patience, but falconers find it very exciting (see *Hawk*).

The Kinds of Hawks That Are Used

Two classes of birds are used in hawking—long-winged hawks, or true falcons, and short-winged hawks. True falcons include the gyrfalcon, peregrine, hobby, merlin, and the kestrel. Short-winged hawks include the goshawk, sparrow hawk, kite, buzzard, and harrier. The sport has a language all its own. The prey is called the *quarry*. Striking the quarry in mid air and clinging to it is *bating*, when game is large, or *trussing*, when it is small. The *lure*, frequently a stuffed body of the quarry, is used to win the bird back after it has been freed. Fighting is *crabbing*, and flying away with the quarry is *carrying*.

FALKLAND ISLANDS. Three hundred miles east of Magellan Strait, near the tip of South America, lie the Falkland Islands—low rocky, treeless, swept by fierce winds, and pelted three-fourths of the year by cold drizzling rains. The full force of the South Atlantic Ocean hammers their ragged coast line, and above the roaring breakers clouds of sea birds whirl and scream.

Of the hundred or more islands in the group, only two are important—East Falkland and West Falkland, the former 95 miles long and 40 miles wide the

latter slightly smaller. On the eastern island is the town of Stanley, headquarters for Great Britain's southernmost colony, which comprises the Falklands and part of the Antarctic region, including the whaling colony of South Georgia, the South Shetlands, the South Orkneys, the Sandwich group, and Graham Land (for map, see Antarctic Continent).

Sheep raising is the chief industry of the islanders, most of whom are Scottish. Wool, mutton, and other sheep products are exported. Shipyards do a good business refitting vessels which have been battered by storms off Cape Horn. Monthly steamers call from England, and there is a wireless station at Stanley. Population (1946 census), 2,239.

Discovered by the British in 1592, the Falklands were occupied in succession by the French, the Spaniards, and the Argentines. England claimed prior ownership and in 1833 set up a crown colony there. Nearness to the southern trade route through the Strait of Magellan makes the islands strategically valuable. In 1914 a German naval squadron was destroyed near here by a British squadron.

FALL RIVER, MASS. Ever since its first cotton mill was built in 1811, Fall River has been a noted center for the manufacture of cotton goods. It was one of the country's foremost cities in cotton spinning and weaving until southern mills took the lead away from those of New England.

Fall River is 49 miles south of Boston. It is situated on a granite cliff that rises steeply where the Taunton River empties into Mount Hope Bay. The bay forms a large harbor, with a channel 400 feet wide and 30 feet deep.

The Watuppa lakes are about 200 feet above the city and two miles east of it. From them the Quequechan River rushes under some of the streets and buildings of the city to the bay. "Quequechan" is the Indian word for "falling water."

The abundant water power and the fine harbor combined with the moist climate, made Fall River an ideal location for the spinning and weaving of cotton. Mills sprang up all along the banks of the Quequechan, and the industry grew to large proportions. As cotton manufacturing moved south, however, many mills were abandoned. The city's population declined somewhat thereafter, after climbing to a peak of 129,485 in 1920.

For many years the manufacture of all kinds of cotton goods was the city's principal industry, but after 1925 many new and varied manufactures were developed. The city now produces cotton goods, men's and women's clothing, thread and yarns, rayon and silk fabrics, curtains, rope and twine, paper boxes, felt and straw hats, jewelry and artcraft metal products, lug gage, and washing machines.

Fall River became a town in 1803 and was incorporated as a city in 1854. Fire swept through Fall River in 1843 and again in 1923. After the 1923 fire a city plan was adopted and streets were widened. The city has a mayor-council form of government. Population (1950 census), 111,963.

FAMILY LIFE—*The Greatest Privilege of Mankind*

FAMILY. Being part of a happy family is the most satisfying feeling in life. Nothing else gives such a sense of *belonging*, of being wanted and appreciated by other people. In the comfort, encouragement, and real fun of happy family life there is no room for self-pity or loneliness.

Money cannot buy or make a happy family. It is made by the members themselves, working and sharing together and respecting each other's rights. In the truest sense, it is "All for one and one for all."

A new family begins when a man and woman marry and set up a home of their own. Usually the family grows as children are born or adopted. A grandfather, an aunt, or other relative sometimes lives in the home and is also a member of the family.

Living Together Is a Full-Time Job

All persons in the family must work together to make a pleasant home. The father is usually responsible for earning a living for his family, and the mother for keeping the home livable and attractive. Her day is busy. Before the father goes to work, she prepares and serves breakfast for him. Often the children of school age can share this meal with him.

The older children help the younger to dress and get off to school promptly. After the mother feeds and takes care of the baby or children too young for school, she washes the dishes, makes beds, and does many other tasks that make life comfortable for her family. She must wash and iron clothes, mend tears and darn socks, plan and cook meals, shop for groceries, and be ever ready to meet any special need of her family. Even though she is her own boss, her job is to plan and work unselfishly for the best interests of her husband and all her children.

They, in turn, co-operate with her, so that every member of the family benefits. Every child old enough to accept responsibility does his share in making family life smooth and harmonious. Nine-year-old

Bill may be teaching Junior how to shoot marbles or catch a ball. Susan, even though she is only 11, helps entertain the baby, dries the dishes, and straightens her own room. Dinner, or supper, with the father home from work, is a high point of the day. The family exchange of news, interest in one another, and freedom from quarrels combine to make a pleasant and relaxing atmosphere for enjoying a good meal. The thoughtful family shows its appreciation of the mother's efforts by giving her little compliments on her cooking.

Companionship and Need of Decisions

At night when the evening chores have been finished, the family is free for companionship. While mother puts the baby to bed, father may help Bill with his arithmetic, or listen to Susan, who wants an increase in her weekly allowance. When mother comes in, they all discuss Bill's request to join the Scouts and Susan's desire for dancing lessons. The family always talks things over. Decisions are made together because all the family is affected by what each member of it does.

When at all possible, parents want their children to make up their own minds and to be responsible for their own actions. To work this out successfully, every person in the family must be co-operative, unselfish, and considerate. When Bill wants a new bicycle, he has to think about the cost. By delivering newspapers he may be able to save all or part of the money to buy it (see Thrift). When he and Susan want to hear different radio programs or see different television shows, they have to "give and take."

Compromise is essential to avoiding friction. If the family budget is to be kept balanced, father may have to wait another year to buy a new car. Mother does without a fur coat so that Bill and Susan can be dressed nicely. To show their appreciation, Bill and Susan study hard at school, take part in class

AMERICAN PARENTS HAVE LEISURE TO HELP AND ENJOY CHILDREN



Left, a proud, happy mother takes time to acquaint her children with a book. Pictures and reading enrich their interests. Right,



the ideal of most parents is to own their own home, where they can work together and enjoy family companionship.

THE HEART OF THE HOME IN MANY FAMILIES



In a happy family mealtime is an enjoyable relaxing time with good food spiced with smiles and fun. This young American couple likes to eat informally in the sky kitchen.

where they can discuss school projects. They especially help Bill and Susan learn how to get along well with other people because that is essential to success in the social and business world of adult life.

A happy family looks forward eagerly to the year's big home events. It celebrates each member's birthday with a little party and makes special occasions of graduations and anniversaries. Thanksgiving Day with its homely spirit is often a time of family reunion—when relatives gather to enjoy the reassuring solidarity of their family ties. Christmas with its gifts and festive decorations is an especially delightful family day (see Christmas Thanksgiving).

Alike Yet Individual

Family members are much alike because they develop together. By having many of the same ideas and habits they learn to share and to get along with each other democratically and co-operatively. They speak the same language, have the same religion. Most important of all, they have the same goal—working together for the welfare of the entire family.

By living together in this way each member is free to pursue any interests and activities that do not limit or interfere with the freedom and rights of other members of the family. In addition to these

activities and help with household chores. On Saturday Bill may help his father wash windows or mend furniture while Susan watches the baby so mother can go shopping. Sometimes they may get paid for chores but they do not demand pay because their real reward is the smooth running pleasant home.

When Sunday comes they may go to church school or attend services with father and mother. In the afternoon they may go for a ride in the car taking food for a picnic supper. Sometimes they roast wieners or have a barbecue in their own back yard.

Grownups Interest Helps Make Happy Family

The chief interest of the father and mother is the children. They like to keep abreast of what Bill and Susan do and to encourage them in ventures that develop their talents. Once a month father and mother may go to the Parent-Teacher Association meeting

freedom. Bill and Susan can look forward to four other freedoms enjoyed by American young people. When they are old enough they will have the freedom to make their own decisions, freedom to choose a mate, freedom from parental interference or authority when each marries, and freedom from domination by the mate because marriage is a partnership (see Marriage). It is these five freedoms that give family life its richness and satisfaction. Home life with its mutual respect, companionship and affection can be both stimulating and rewardingly happy.

Unexcelled Advantages of American Families

Nowhere in the world does a new family begin with more advantages than in the United States. Although the parents may not approve the marriage the bride and groom were free to make their own choice of a mate. The freedom of American men and women to

marry whom they choose and to set up separate homes for themselves is unmatched elsewhere. Married couples may live where and how they please without having to accept any advice from relatives. Either the husband or wife, or both, may work. Whatever their income, it belongs to them and may be spent in any way they wish. These are privileges enjoyed by all couples, regardless of class, race, or religion.

In contrast to married people in some other lands, an American couple is under no obligation to their parents or to the state to have children. Except for religious reasons, a couple may limit the size of its family as it chooses. If the marriage fails, either husband or wife may get a divorce on legal grounds, though most religions discourage divorce.

Privileges of Leisure in the American Family

With a work week rarely over five days or 40 hours, husbands have much leisure time to devote to their families. Unlike millions of women in other countries, American wives also have leisure. American women have been released from drudgery by automatic stoves, electric appliances, washers, refrigerators, sweepers, and innumerable gadgets. Children, instead of laboring long hours in fields or factories, now have the opportunity of both education and leisure. A mother with young children can have help with her teaching responsibilities by sending the children to nursery school or kindergarten. As her children mature and marry, the American wife has more and more leisure at her command.

The American family has adapted itself remarkably to its opportunities and privileges. In little more than 300 years the patriarchal (ruled by the father) family of colonial days has changed into a modern democratic family with its "five freedoms." (For colonial family life, see *American Colonies*.)

Modern Problems and Family Counselors

With all this progress, however, many families do not yet enjoy all the privileges and opportunities. Slum districts, which put a strain on family life, remain in many cities (see *Housing*). There are poor farming areas where the standard of living is low. In some homes the father or mother continues to dictate to the family, though the trend is to accept the parents as partners. Not all families have adequate health care or modern conveniences (see *Conservation*, section on "Conserving Human Resources").

Even in the average American family—which is well-housed, well-fed, well-clothed—stress may arise. The young wife is often overworked. Taking care of her family, training her children, and keeping her husband contented put great strain on the young mother. The young husband is often worried by money problems. Both father and mother may be distractedly concerned over an ill or unruly child.

To avert the breakdown of the family and to prevent the rise of another tragic "broken home," many organizations offer "family counseling." They aim to help family members "to develop both the capacity and opportunity to lead personally satisfying and socially useful lives."

A SCENE IN ANY AMERICAN TOWN



Freedom to practice religion is one of the greatest privileges of the modern American family. This typical family begins Sunday, the traditional day of rest, by going to worship.

The first charity organization for counseling was founded in Buffalo, N. Y., in 1877. The Family Welfare Association of America goes back to 1910. The federal government has developed several agencies, such as the Children's Bureau (1912), to strengthen family life. Juvenile and family courts, churches, and other community or national groups furnish skilled workers to advise on family problems.

Such family counseling is available to all families, regardless of race, religion, or age. Problems may arise long after marriage. A middle-aged wife, for example, may find much spare time on her hands after her children are married. This sometimes leads to unhappiness and a feeling that she is no longer useful to herself, her family, or society.

History of the Family

Little is known about the family in earliest times, for it existed long before people could write to leave a record. The early family must have lived very

SPRUCED UP FOR FAMILY PARTY



Birthdays, holidays, and plain get-togethers are gala times in happy families. Here the young family has come to grandfather's and grandmother's for a traditional turkey dinner.

THOUGHTFUL PARENTS TAKE INTEREST IN CHILDREN'S WORLD



Mothers and fathers have come out to one of the large play grounds in Chicago to watch their boys and girls sketch and paint (left). This is one of the fastest growing youth hobbies.



Lucky is the teen-ager whose dad has a basement workshop and works with him on repairs (right). Together they can also make things for the home. The pop waits patiently for his romp.

simply for it took man thousands of years to learn how to make fire tools and weapons (see Civilization on Man Stone Age). Wherever man lived he probably moved around in his search for food. It is likely that his family and families of close relatives lived together forming a joint family. In this way they were better able to defend themselves against dangerous animals and enemies. Even today a form of the joint family exists in some parts of China, India, and perhaps other places.

When food became scarce, large families may have divided into smaller groups. As they wandered in the search for food, they may have become widely separated. This perhaps is how different family groups or clans started, though no one knows. (For information on Scottish clans see Scotland.)

Because men were stronger than women, the father was usually the master in the family. This type of family leadership is a patriarchy, meaning father

rule. If the father were killed or joined another family, the mother often became the permanent head of the family. Where the mother rather than the father is the head of the family, the family form is a matriarchy, mother rule.

In the old patriarchal family the father was an absolute ruler. He had full power over every member of the household. If his children married and came to live in his household, he also ruled their wives or husbands and their sons and daughters.

Tribes, Nomads, and Totem Clans

In some lands two or more clans grouped together to form a tribe, which was ruled by a chief. Because their existence depended on good crops, tribes performed ceremonies or offered sacrifices to rain gods and other deities for bountiful harvests. Sometimes a powerful priesthood became the rulers of a tribe. This type of rule was a theocracy and existed in Egypt and the Aztec lands.

FORTUNATE YOUNG AMERICA ALWAYS ENJOYS EATING

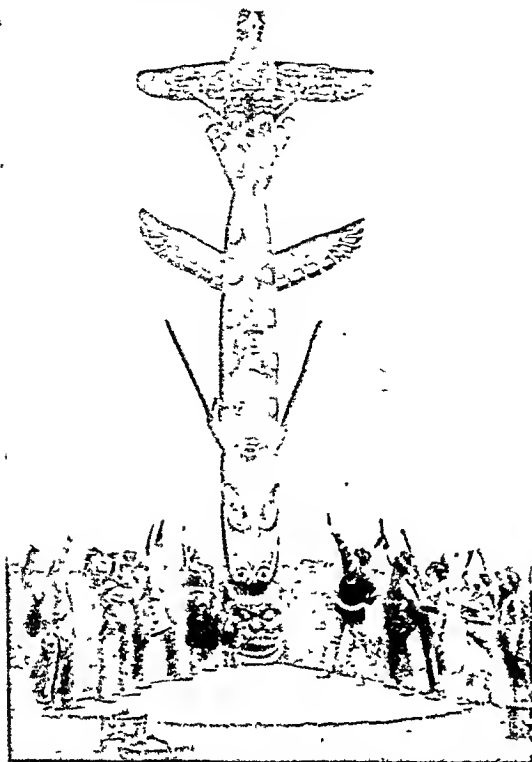


Families near the shore relish picnics within the sound of the waves. Outdoor meals are a family favorite throughout America—in the woods, the mountains, and right in the back yards.



These teen-agers have earned the privilege of entertaining at home. They have proved themselves responsible persons and do not have to resort to going to questionable places for 'fun'.

FAMILY TOTEM POLE



Some Indians revere totem poles. They carve a log into symbolic figures of the plants or animals that are their totems. The pole shows the life of a clan or the events in a single family. This pole was carved by Haida Indians in Alaska over 100 years ago. It now stands in Lincoln Park, Chicago, Ill.

Throughout the world many tribes were nomadic. That way of family life continues today in Arabia, Mongolia, and some other lands (see Arabia; Eskimos; Gypsies; Mongolia). Families living in trailers and families of the armed services' personnel, who are

moved from post to post, have been called "modern nomads." Their frequent moves often affect family life, as they require readjustments to education, ties of friendship, and living conditions.

Some American Indian tribes—the Iroquois, Pueblo, and northwest coast Indians—have a strong clan system. The clan consists of people who consider themselves related by descent from some mythical animal or from an ancestor who had unusual experiences with that animal. The clan members use a representation of the animal as their badge and are known by its name. The ceremonial rights of the clan are inherited through the female line. This system is called *totemism*, and the animal or its symbol is a totem.

Kinship and Forms of Marriage

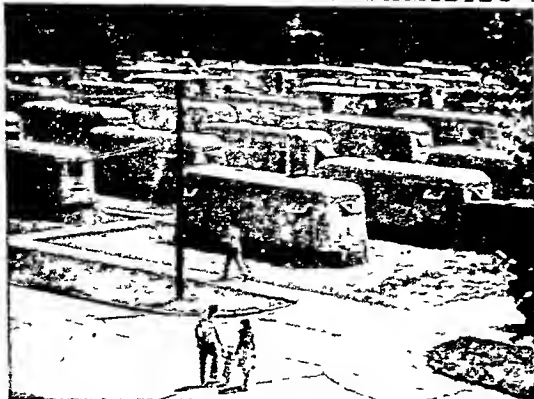
In primitive societies, even today, the way of living partly depends on the way kinship is recognized. If family kinship descends through the mother, the family is *matrilineal*; if through the father, it is *patrilineal*. After marriage, if a couple lives with or near the husband's parents, the family pattern is *patrilocal*; if with the wife's parents, it is *matrilocal*.

Family life is also affected by the form of marriage. When a man has only one wife, or a woman has only one husband, the marriage form is *monogamy*. This is the kind of marriage practiced by most civilized nations. Some primitive people also observe it. The form where it is lawful to have two or more mates is *polygamy*. When a man has two or more wives, it is *polygyny*; when a woman has more than one husband, it is *polyandry*. In *concubinage* a man has one wife and one or more mates who are part of the family, but they and their children may have only limited rights.

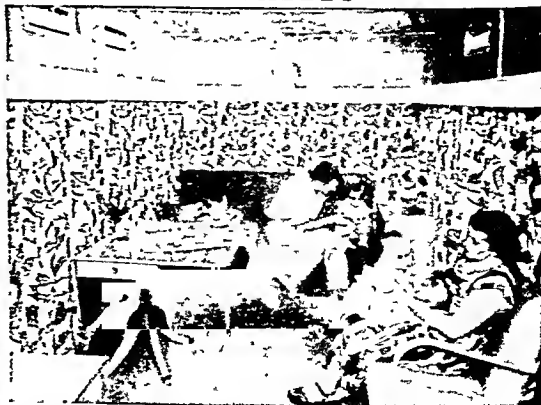
Family Life in Other Lands

In Moslem groups—as in Arabia, Egypt, the Philippines—family life is much the same despite national differences. A newly married couple usually lives for some time in the home of the husband's parents and are under control of his father. Until a son is two years old, or a daughter is seven, the child is in the mother's care. Then the child enters the

AMERICAN FAMILIES ALSO LIVE ON WHEELS



Well-regulated trailer courts (left) are the homes of many modern American families, even those with young children. The return of men from World War II greatly spurred the



movement. When everyone in the family helps to keep the compact quarters tidy, a trailer can be a happy home (right). Even the little youngsters must quickly learn to place their toys in a box.

ECONOMIC HARDSHIP FALLS HEAVILY ON MANY FAMILIES



When mothers are forced to work to support their children, the youngsters lose many benefits of home life. These Chinese children of farm women try to enjoy a village nursery (left).



Right: the forlorn expression of the little fellow tells the tragedy of his broken home. Daddy deserted him, and mother is checking him and herself into a home for working mothers.

custody of the father or a wali, a legally appointed guardian. The father or wali has full power over the children in arranging their marriages or divorces. (See also Mohammed.)

Family life in China is traditionally patriarchal. A husband's first duty is to his parents; the wife's is to her parents-in-law. In rural areas especially, many marriages are still arranged by parents. Until recent years, no wife could get a divorce; today, in cities, most divorces are granted by mutual consent.

Until the 20th century, family life in Latin America was patriarchal, patterned after that of ancestral Spain. Both by civil and religious law, the father was master of the home. Although women were esteemed and closely protected, they were subject to their husbands. Few women learned to read and write.

Today, the average Latin American family is steadily growing in freedom and democratic ways. The growth of industry has encouraged many people to move to

cities where they can find jobs in business and industry and have incomes of their own. Instead of living with their parents, couples now set up their own homes and send their children to school. Affection and co-operation are displacing authority in governing Latin American families.

Nowhere has family life changed so quickly and drastically as in Russia. The old Russian family was patriarchal but strong and united. The rise of Communism after the first World War disrupted the family pattern. Young people could keep their own wages, marry whom they pleased, and divorce when they pleased. Family life became so lax that in 1944 the state enacted laws making divorce almost prohibitively expensive. It also paid bonuses for large families. Whether these changes have helped or hurt the Russian family, only history can tell.

Nearly every form of family that has been studied in the long history of man can be found in some part

THE STRONGEST TIES IN THE WORLD ARE FAMILY TIES



Although there are many broken homes, the vast majority of American families keep and cherish their home ties. When possible, many of them gather to enjoy the bonds of kinship.

Throughout the year, various groups gather for picnics back at the old farm or town. Here is a reunion of some of the huge Doelittle family descended from a Connecticut colonist.

of the world today. One isolated group may live in caves; another may occupy tents or mud huts. One tribe may depend on wild game and wild plants for life; another may live on food grown by the most primitive methods. Among one people the standard of living may be very poor; for another people the standard may be quite high. Even in a civilized nation, poverty and wealth may exist side by side.

World-Wide Function of the Family

Whatever its form, however, the family is the basic unit of society; and family membership is the most prized privilege of life. Upon the family falls the responsibility of passing to the next generation the culture of the parents and ancestors. Language, traditions, religion, customs, and ideas are the heritage of the family, whether primitive or civilized. No one can doubt that the supreme social function of the family, in every part of the world, is the transmission of culture through the ages.

FARADAY, MICHAEL (1791-1867). The great scientist Sir Humphry Davy was once asked what he considered his greatest discovery. "Michael Faraday," was his answer.

Michael Faraday was the son of a London blacksmith. At 13 he was apprenticed to a bookbinder. He read all the scientific books that he could find in the shop, and thus attracted the attention of one of the customers. This man gave him tickets for lectures by Sir Humphry Davy. Faraday made careful notes of the lectures and sent them to Davy, asking for a position. Impressed by the boy's zeal, the scientist took him into his laboratory as an assistant. Faraday then went on to become one of the greatest experimental scientists of all time.

He made many notable contributions to chemistry and electricity. Acting on hints from Davy, he succeeded in liquefying several gases by compressing them. When he discovered the hydrocarbon *benzene* in 1825, he became the father of an entire branch of organic chemistry. His laws of electrolysis, formulated in 1834, linked chemistry and electricity (see Electrochemistry).

His greatest achievement, however, was the discovery of electromagnetic induction (see Electricity). He found in 1831 that when he moved a magnet through a coil of wire, a current was produced. This discovery grew finally into the electric generator, the heart of all modern electric power plants.

Late in his career, Faraday discovered that the plane of polarized light is deflected by a strong magnetic field. His work in this field led James Clerk Maxwell to the brilliant theory which tied together electricity, magnetism, and light and led indirectly to the invention of radio (see Radiation).

FARM CREDIT. Every spring farmers need money to buy seed and hire labor. Often they borrow the money and repay the loan after they have marketed their crops. Sometimes they also need loans to carry them through years when crops are bad—or even years when crops are so good that prices of farm products fall very low. When buying a farm they usually pay only a small part in cash and give a mortgage for the balance.

The credit needs of agriculture are different from those of industry. Merchants and manufacturers have a fast turnover and get loans from banks for very short periods, usually not more than 90 days. Farmers may need six or nine months to repay even a "short-term loan," from the money received for their crops. "Intermediate loans" may run for several years, and mortgages—"long-term loans"—for a much longer period. Banks can put only a small part of their funds into long-term loans. Local banks lending chiefly to farmers run the risk of crop failure in their districts or of a country-wide bumper crop that sends prices tumbling. For these reasons banks charged farmers high interest rates.

In 1916 the United States government created the Federal Farm Loan Banks to extend cheaper credit to farmers. In 1929 it added a Federal Farm Board. In 1933 these organizations were merged into a Farm Credit Administration. In 1939 the FCA was made an agency of the Department of Agriculture.

The FCA supervises a complete, nationwide farm-credit system. The country is divided into 12 farm-credit districts. The headquarters city in each district has the four following major credit units:

The *Federal Land Bank* makes long-term mortgage loans for the purchase of land, buildings, and equipment through national farm-loan associations. A farmer applies to his local association for a loan. Funds are obtained principally by sale of bonds to the public. The *Federal Farm Mortgage Corporation* helps finance lending operations of the Federal Land Banks and the Land Bank Commissioner.

The *Production Credit Corporation* supervises local cooperative "production credit associations," which make short-term loans. Farmers may borrow from these local associations to finance production of crops, breeding and marketing livestock, improvement of buildings, and the purchase of seed and equipment.

The *Federal Intermediate Bank* discounts notes given by farmers who borrow from production credit associations. It sells debentures secured by the notes to the public.

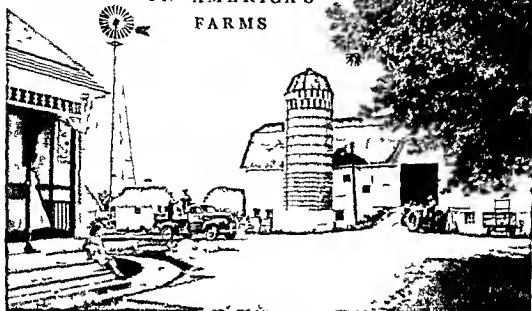
The *Bank for Cooperatives* makes loans to farmer cooperatives to help them finance their operations.

MICHAEL FARADAY



One of the world's greatest experimental scientists, he worked in two major fields.

LIVING AND WORKING ON AMERICA'S FARMS



A Midwest Farm Home and Family on a Pleasant Day in Summer

FARM LIFE IN THE UNITED STATES. Crowing roosters announce the dawn on nearly every American farm. In the early mornings of the growing season, fresh odors of growing crops and blooming flowers fill the air.

Even before daybreak in a farm country lights begin to twinkle here and there. Everyone gets up early and on every farm day starts in much the same way.

Before the family has breakfast the animals must have theirs. The chickens and other farm animals are fed first. Then there are other chores to be done. The cows must be milked and fresh clean straw put in their stalls. Horses need to be turned to get dried mud or tangles out of their hairy coats.

After the chores are done the family is ready for a big breakfast. The farm breakfast starts with fruit juice or fresh berries from the berry patch. Then come heaping bowls of cereal with fresh cream and good country ham or bacon and eggs. Mother, father and the children drink big glasses of cold milk from a huge pitcher.

After breakfast the farmer, the older son and the hired

man go into the fields to work. The younger children help their mother put away the milk or separate the cream from the milk in a cream separator. Then the girls help with the housework. One of the boys calls the dog and takes the cows to pasture. He may ride



SEPARATING THE MILK AND FEEDING THE CALVES



The little girl at the left watches her mother separate the cream from the milk, hoping to get a panful for her kitten. The boy at the right is teaching a calf to drink from a bucket. A second animal tries to crowd its head into the pail for a share.

on one of the cows and drive the rest of the herd ahead of him with a switch.

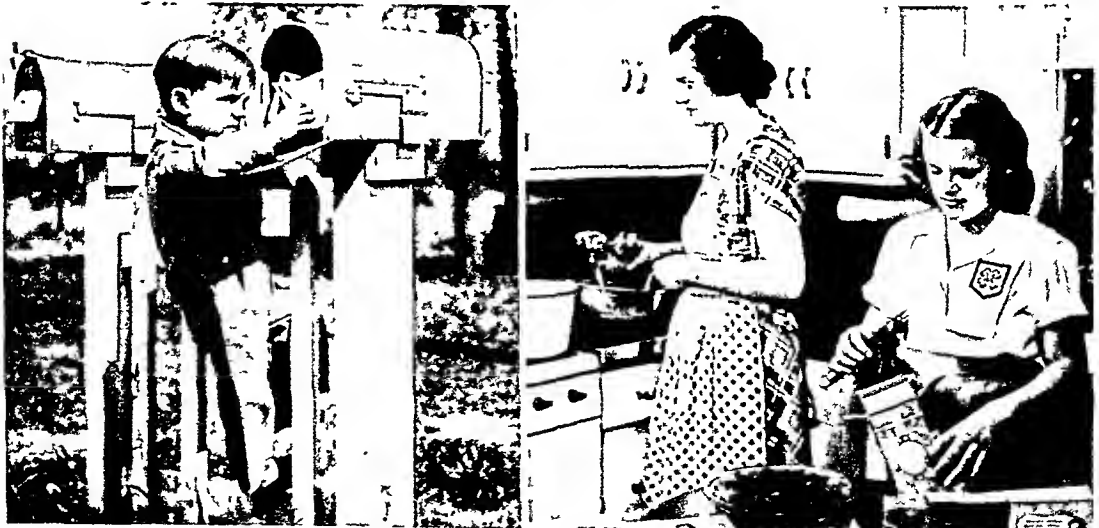
If we visit a general farm in the Middle West or East on a day early in the summer, the farmer may be harvesting oats. This is one of the earliest crops. The farmer, his older son, and the hired man may have hitched a tractor to the combine. This is a machine that in one operation cuts and threshes oats or other small grains. As the oats are threshed they are loaded into a wagon or truck and hauled to the granary for storage.

The younger boy helps in the fields too. He carries water to the men. Then he may ride on the tractor with his father or his big brother as the combine

gathers up the oats. It is also fun to ride back to the farmyard high on top of a big load of oats.

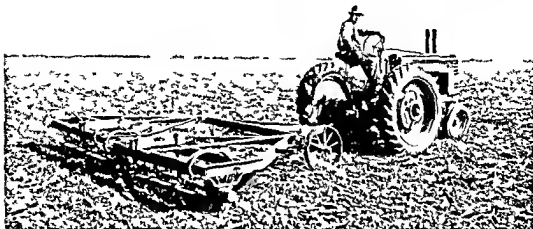
During the morning one of the children runs down to the mailbox near the county road to get the mail left by the rural delivery mailman. Unlike a city mailman, he drives in a car because of the distances between farms. When school is in session, the children walk down this road to their school if it is only a short distance. Or they are picked up by the school bus which takes them safely and in comfort to a consolidated school. The consolidated school has classrooms and teachers for the different classes the same as a city school. It has replaced the one-room schools in many rural school districts.

EVERYBODY HELPS ON THE FARM



Each boy and girl has tasks to do on the farm. The little boy is taking the mail from the roadside mailbox. The girl is helping pack broccoli for the deep freezer. After her mother parboils the vegetable, she puts it in a box with a plastic liner.

SURE SIGN OF SPRING—PREPARING A FIELD FOR PLANTING



This farmer is preparing a field for planting. The tractor draws the corn planter, which cuts up corn stalks left on the ground after last fall's harvest. This makes it easy to plow the soil and to plant corn. As one means of controlling the corn borer, the stalks are so enriched the soil.

Many farm communities also have good library service from county libraries. Books are often brought to schools in trucks fitted with shelves. These are called bookmobiles.

Many things are the same on the farm as in the city. The telephone and radio keep the farmer in close touch with local and world affairs. The telephone also helps get the doctor or the neighbors quickly in case of emergency. In some farm communities a certain number of rings on the party telephone line is a signal for the neighbors to assemble and help put out a fire. Modern machinery and electrical equipment have solved many problems for farmers. But if fire breaks out, fire trucks and firemen are

seldom available except very near large towns. Even then few farmers have a large enough water supply to make use of the equipment. So fire is one of the farmer's greatest enemies.

Farm and City Family Life

Family life on the farm is very different from family life in the city. In the city the head of the family leaves his home in the morning to work in his office, factory, or store. Usually he is away all day. His family doesn't see him again until that night. He may discuss his work with his wife and children, but they seldom share in it.

On the farm the whole family shares in the farmer's work and problems. The family spends much time out-

CATCHING THE BUS TO THE CONSOLIDATED SCHOOL



Here farm girls and boys hurry to the school bus. A patrol boy watches for traffic. Of an average of 100 buses are needed to bring the girls and boys from a large part of the district to their consolidated school, and their routes may be several miles long.

of-doors. The farm also provides pets and material for hobbies and amusements. So the family unites in working and playing together.

At noon on the day of our visit the men and boys come in from the fields for dinner. They listen to the radio while they eat. Everyone is interested in the weather forecast. They hope it will not rain before all the oats have been stored. When it rains, work in the fields must stop. On rainy days farm equipment may be repaired, or the family may go to town or visit neighbors. Improved roads and automobiles make travel easy, even in bad weather.

Today the weather remains fair and there is more work to be done in the fields after dinner. The girls and their mother pick vegetables in the garden. Later they will can some of these vegetables and store some in the deep freezer along with fruit from the orchard.

After the girls finish their work it is fun to go out and play in the haymow. They slide in the hay and play with the barn cat and her family of kittens. In the evening the girls collect the eggs in the hen house.

When the day's work is finished in the fields, it is milking time again, and the cows are brought back

GATHERING EGGS



These two girls are gathering eggs in the chicken house. This is an easy task, unless a broody hen fights to stay on the nest.

from the pasture. The farm animals want their supper now too, and the boys and men join together to do the evening chores.

The family supper is another big meal. After supper everyone goes to bed early. All are tired from their day of work and fun in the open and are looking forward to another busy farm day.

Farm Life in Different Sections

Farm life varies in different parts of the country. A farm day such as described is typical of summer farm life in the Middle West and parts of the South and eastern United States.

In the Far West and much of the South, farm work and life are somewhat different. This is so because of difference in climate and in the types of crops raised. In parts of the South and the Southwest cotton, citrus fruits, and truck farming call for somewhat different daily routines. In the West huge combine crews harvest the great fields of wheat. In the Far West many cowhands ride the range with great herds of cattle.

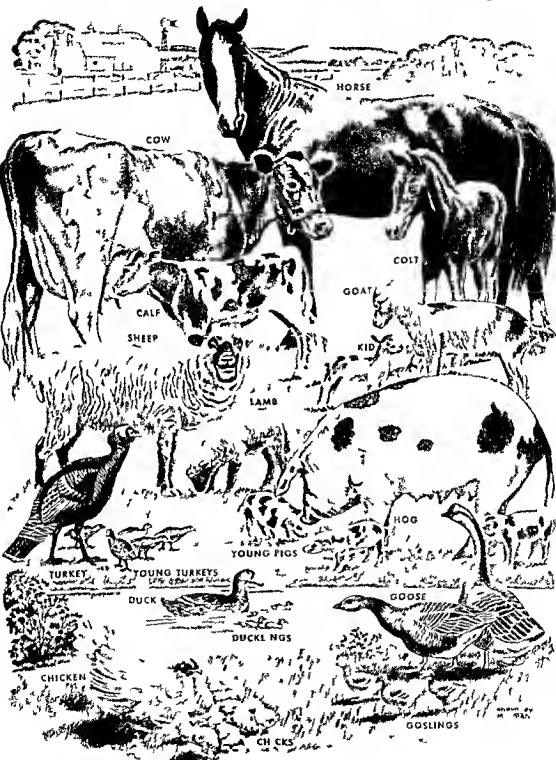
For the most part, however, there is a general similarity in farm life in all parts of the country that makes all farming a brotherhood.

A CHORE FOR MORNING AND AFTER SCHOOL



Driving the cows to and from pasture has always been a chore for farm children. These youngsters have to be very careful in crossing the road and railway with their valuable dairy herd. Often the farm dog is trained to help the children with this task.

FARM ANIMALS AND THEIR YOUNG



HEALTHY WORK PICKING FRUITS AND VEGETABLES



Here is outdoor work that is fun too. The two boys (1) are picking string beans. Another boy (2) has stopped at the family apple orchard on his way home from school to pick some apples to eat. The two girls (3) are crating big red tomatoes. The boy picking strawberries (4) and the girl picking peaches (5) can eat their fill and still have plenty left over for home use and marketing.

Farm Life Through the Year



Plowing is done in the spring. It is a hard job for the farmer. The plow is a heavy machine. The farmer has to use a lot of strength to pull it. The soil is very hard and the farmer has to work hard to turn it over. The farmer has to be careful not to damage the seeds that are in the soil. The farmer has to be careful not to lose any of the seeds. The farmer has to be careful not to lose any of the seeds.

IT IS OFTEN said that the farmer is his own boss. This is largely true, but the farmer does have one very important boss—the weather. In a few parts of the United States the weather is generally warm or hot and crops grow most of the year. But in most sections of the country there are four seasons—winter, spring, summer, and fall. The farmer must be prepared to do his tasks to these seasons.

Like any good business man, the successful farmer plans his work well ahead of time. In the winter when work is light on most farms and the children are in school, the farmer makes his plans for the coming crop season. He studies books and pamphlets from the state and federal agriculture departments and decides what his main crops will be. Perhaps he talks over his plans with the county agriculture agent.

Crop Rotation

One question he must settle every year is rotation of crops in his different fields. Crop rotation gives rest to fields and rest through one season so they regain their fertility. A typical four-year method of crop rotation is to plant oats in a field where corn has been the year before. At the same time and in the same field the farmer plants clover or alfalfa. This

grows slowly while the oats are getting ripe and can be used for fall pasture after the oats are harvested. The next year hay is made from the clover or alfalfa. In the third year the field is used to pasture cows. In the fourth year the hay sod is plowed under, furnishing plant food to the soil. Corn uses up much strength from the soil. The plowing under of the hay sod restores the strength in the form of nitrogen and other elements. The following year corn is planted in the field, starting the rotation cycle all over again.

PLOTTING BEST LAND USE



A good farmer always plans his crop program well ahead of planting time. This is one of the things that make him a successful farmer. He makes plans for the coming season.

In the early spring the farmer spreads fertilizer and begins to plow and harrow his soil. At this time of the year many of the young farm animals are born and require special care. If the weather is rainy or cold, the farm family brings the cows and calves, ewes and lambs to the barn to protect them. They put a heat lamp in the hog house to warm shivering young pigs. Perhaps the parcel post brings tiny chicks from a hatchery. They go into the brooder house.

All of the farmer's wisdom is needed to decide just when he must plant so the harvest will have time to mature. He must not plant too soon, be a late freeze might kill the tender young growth. But he cannot wait too long without running

into danger of frost at harvest time. In many parts of the country the growing season between spring and autumn frosts is just about long enough for important crops. If a farmer is a few weeks late in planting, frost may come before the crop is ready for harvest.

When the warm spring days arrive, and the farmer feels the soil is just right, he goes to work planting wheat, oats, corn, and other crops. Here he is aided by the use of improved crop seeds. He can plant fast-growing corn, for example, that will ripen for harvest in from 85 to 90 days. The usual maturity period is from 100 to 120 days.

Cultivating and Early Harvesting

"Good corn weather is good weed weather." The farmer must cultivate

EACH SEASON BRINGS NEW FARM TASKS



parts of the country hayfields bear two or three crops a year, with the first crop ready in July.

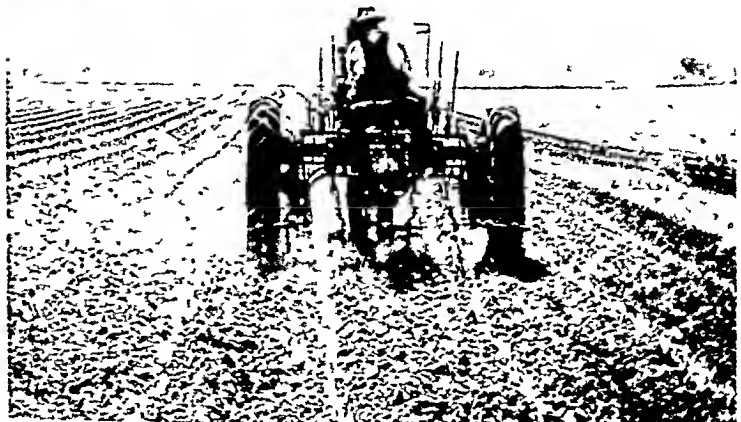
After hay is cut it must be cured. Many farmers leave it in the field to cure. At a threat of rain they haul it to the hay mow, because wet hay molds. But some farmers put hay in scientifically ventilated mows to cure artificially.

In the past, harvesting was much harder work than it is today. Modern machinery takes over many of the tasks that were once done by hand, such as pitching hay from the ground to the top of the load, or from the load to the



corn three or more times during May and June until the stalks are sturdy enough to withstand the crowding weeds. He uses the tractor to pull the cultivator down between the rows. Its sharp, shallow blades loosen the soil and uproot the weeds without harming the young corn plants. If rain has delayed his work, he can continue cultivating at night. His tractor has a headlight for that purpose. In the Middle West corn should be "knee high by the Fourth of July." Not much more work is needed in the cornfield until fall, when it is harvested.

When the farmer has finished cultivating his corn, he may have a crop of oats as well as winter wheat to harvest. And in many



1. A farmer feeds his hogs during the winter. 2. During the winter farmers also repair their machinery, such as this disk. In the spring the disk will be used to break up the soil and prepare it for planting. 3. This farmer is cultivating young corn. He will cultivate it several times during the summer. The cultivator removes weeds from between the rows of corn. It also loosens the dirt around the corn. Then air can get to the roots and help it grow.

FLOWING AND PROTECTING THE VEGETABLE GARDEN



Often the farmer and his son will use a one horse plow instead of a tractor for plowing the small vegetable garden. By midsummer the garden looks fine, but many plants still must be sprayed or insects may destroy them. The garden will give the family fresh vegetables through the summer and plenty to spare. A supply for winter use can be preserved or stored in the deep freezer or locker.

haystack Today three men working with modern harvesting machinery can do the work of ten men working by hand or using animal power.

Busy Vacation Days for Girls and Boys

Vacation days on the farm are filled to overflowing with interesting things to do though much of it is hard work. School is out. There are gardens to tend, fruit to pick, and animals to feed. Everybody helps.

An older boy learns how to cut up seed potatoes so that each segment has an eye in it. He drops the pieces at proper spaces in a furrow in the field and his father turns the loose earth over them with a plow or cultivator. Then a plant will sprout from each eye.

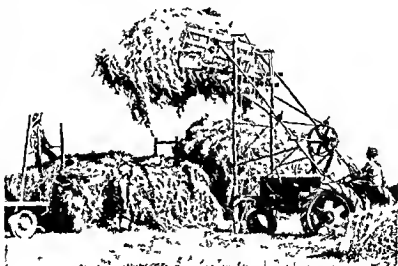
In the early autumn the children all look forward to picking the apples in the orchard and storing them in the cellar for winter eating. The girls and boys rake up orchard windfalls and haul the spotted fruit to the hog trough. Windfalls are apples that have been blown to the ground by the wind and not picked from the trees by hand.

In hitting the ground they are bruised. If they were stored with good apples, all of the apples would rot.

Biggest Harvests Are in Autumn

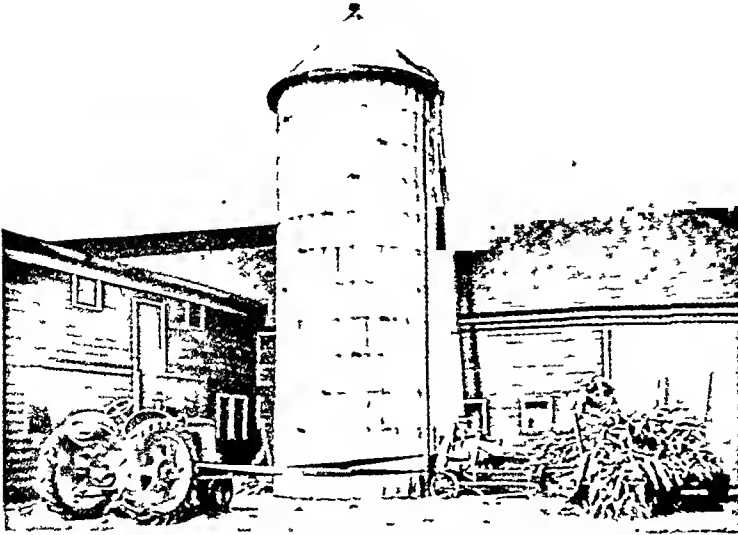
In the East and on Middle Western farms the heaviest work of harvesting comes in late summer and early fall. Dairy farmers may cut green corn and chop up the whole plant for storage in the silo. There the chopped plants steam and ferment into silage.

STACKING HAY BY MACHINE



The hay loader is one of many machines that make work lighter at harvest time. Here it is lifting hay from a wagon to a stack. Often it is also used in the field to load the hay onto the wagon. This avoids the hot, hard work of piling the hay by hand.

"SALAD" FOR THE COWS IN WINTER



This farmer is chopping cornstalks and ears of corn into fine pieces and blowing them into the silo. A tractor gives power for the chopper and blower. Cows will be fed this silage from the silo during the long winter months.

Silage is "salad" for the cows. They like this semi-green food, just as people like preserved garden vegetables. The cattle eat their silage salad along with their main meals of hay and grain in the long winter months when there is no grass in the pastures.

Other farmers wait until the ears of corn are well hardened in the late fall before harvesting them either by hand or with a corn picker. This corn is stored for feed or is to be sold on the market.

If winter wheat has been harvested, the farmer must plow his field again and plant a new crop in

good time before the first hard frosts. Winter wheat is wheat that has been planted in the fall (see Wheat). Perhaps he also harvests a crop of soybeans. These are harvested and threshed in much the same way as oats. He sells the beans to an oil factory and keeps the vines for hay or additional silage.

Meantime, he begins selling fat cattle or pigs. But he keeps some stock to feed and fatten to greater weight for sale during the winter. Many Middle Western farmers buy young "feeder" cattle which have been shipped from the western grasslands. They fatten these animals on grain before selling them.

Fall or early winter is butchering time on some farms. The farmer slaughters several hogs, and home cures delicious hams and bacon for family use. He

may join with a neighbor to butcher a steer and share the beef. Often the family keeps the meat in a deep-freeze cabinet or in a frozen-food locker in the nearest town.

Of course seasonal work varies with the climate in different parts of the country. Winter is the season of planting, cultivating, and harvesting on the truck farms of the warm South and Southwest. The citrus fruit growers of these regions pick their fruit in winter too. But in most parts of the country, autumn frost and winter snow put an end to crop growing.

"SENDING GRAIN TO MARKET ON FOUR FEET"



A corn-belt farmer is "sending his grain to market on four feet." He has fattened the cattle on corn, and now he sends a truckload to the stockyards for sale. He may have raised the cattle himself or bought them as "feeders" from some western range.

This gives the farmer a rest from heavy work. But he must still feed and look after his stock. He spends part of his time repairing and remodeling his buildings, servicing his machinery and repairing or building fences. Yet during the quiet winter days he finds plenty of time to read his books and farm magazines or the bulletins issued by the state and federal agriculture departments.

Fun on the Farm

IN SPITE of all the farmer

and his family must do farm life is not all work.

In the autumn and winter

after the crops are in, the boys and men may go hunting. Sometimes neighbors organize big hunts to destroy crop and stock enemies such as coyotes, foxes and rabbits. Many farm boys set their own traps and earn spending money from selling the skins of small fur-bearing animals caught in this fashion. Good books for long winter days indoors are made available by rural library services. And in the northern states in winter there is skating, skiing and sledging on frozen creeks, ponds and snow-covered hills.

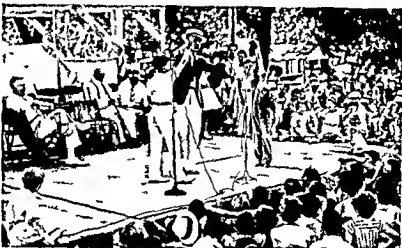
The farmer and his boys may go fishing or swimming in the summer when the weather and their work

permit. And perhaps there is a pony for the children to ride. Baseball is played regularly with teams of boys from surrounding farms and the local town.

At school basketball and football are played. Basketball is a year-round sport in some rural school areas since it takes fewer boys and less expensive equipment than other sports. Six-man football and softball have also become popular in many places. Whatever the school sport, the entire community is devoted to its teams and enthusiastic in supporting them.

Farm families enjoy visiting on Sun days and

FUN FOR ALL AT THE FARM PICNIC



Many farm communities hold a picnic or one-day fair every summer. Rides and concerts are hired. A few professional entertainers are also hired, and the entertainment program is filled out with local talent. In the picture a fiddler entertains just ahead of the outdoor stage.

in the evenings. They can go easily from one farm to another by automobile. Churches and clubs have parties, picnics, and bayrides in summer, and sleigh rides and barn dances in winter.

Saturday is the traditional day for the family to come into town for shopping and recreation. The automobile and improved roads make such trips possible at any time when farm work is not too heavy. Saturday is a big day in town. Stores remain open late in the evening, movies are full, cars line the curbs, and banks are often open late. There is a strong community spirit in the air as farm families

PETS HELP PROVIDE OUTDOOR PLAY AND SPORT



Farm children find plenty of time to have fun with their pets and hobbies. The little girl is riding her pony. The two boys and the dog are acting out a hunting scene in the bright autumn woods. They have proved themselves good shots by bagging a squirrel apiece.

A 4-H CLUB HOLDS AN OUTDOOR MEETING



Outdoor meetings like this one help farm girls and boys live up to an important part of their 4-H Club pledge: "I pledge my health to better living." The 4-H Clubs form the world's largest rural youth organization. The motto is, "To make the best better."

meet one another on the main street and exchange bits of news. The men talk over the crop prospects, the women compare notes on housework and club meetings or perhaps show some new dress material they have just purchased. The children join together in going to a movie. At night everyone may attend the band concert if it is a summer evening.

One of the things farmers like to do best is to attend farm sales and auctions. These occur most often in the spring and fall when a farm is being taken over by a new tenant. The old tenant's stored grain stock and farm equipment are auctioned off by a professional auctioneer. There is always much spirited competition and good-natured rivalry among the assembled farmers to see who can get the best bargain. But farmers often will not bid for equipment, stock, or grain they feel the new farmer needs.

Adult and children's rural groups meet for work, study, and play all during the year. These include such organizations as The Grange, The Farm Bureau, The Farmer's Union, Future Homemakers, Future

Farmers, New Farmers of America, New Homemakers, Home Demonstration, and 4-H Clubs (see 4-H Clubs).

In the late summer and fall farm people go to county and state fairs for a good time. There is a holiday atmosphere at the fair. The farm families

have worked hard most of the year. Now the farmers, their wives, and children relax and enjoy themselves.

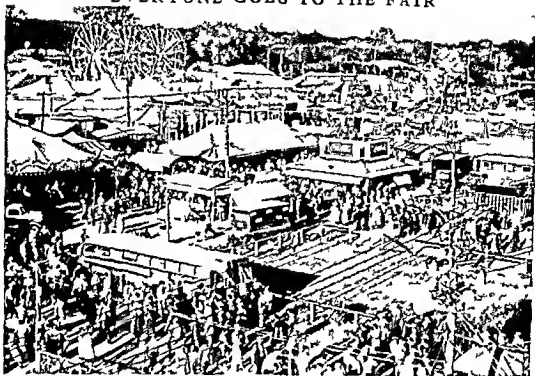
The men display their best stock and produce and compete for prizes in contests. Women enter their canned vegetables, baked goods, and needlework. As 4-H Club projects many girls and boys have raised calves, pigs or lambs to exhibit. The girls also show dresses they have made and fruit and vegetables they have canned. Farmers go to winter livestock shows in the cities and to meetings of county, state, and national farm organizations. At these meetings they get up-to-date farming information. The outstanding community leaders in a farming community are usually the people who have taken part in these various activities.

SHOWING A PRIZE-WINNING DRESS



This farm girl is showing a dress she made as a 4-H Club project. She entered it in a contest at a tri-county fair held in the Middle West and won a prize.

EVERYONE GOES TO THE FAIR



County and state fairs such as the one pictured at the top provide exciting times for everyone. They are held most of us in the late summer and fall. The whole farm family looks forward to seeing the exhibits and competing in the contests. At the fair farm girls and boys have a chance to win prizes for animals they have raised as 4-H club projects. The boy is driving a Chester White hog into the judge's ring. The 4-H girl is showing her Shorthorn steer which won first prize at a county fair.

PRIZE-WINNING 4-H CLUB PROJECTS



1. A 4-H girl is putting a skirt on a dressing table as a Home Improvement project. 2. This girl won a state food contest. She is practising baking cherry pies for the national contest. 3. A farm girl exhibits her prize-winning preserves. 4. This ten-year-old boy won his blue ribbons for his champion Duroc barrow. 5. A 4-H boy with a Shropshire lamb. 6. This 4-H boy won his blue ribbon for showing the champion White Leghorn hen in competition with others from 17 counties.

Extension Workers Aid Farm Families

IN THE past half century farm life

has been improved by the Federal Extension Service developed by the United States Department of Agriculture. It works from the Department of Agriculture in Washington D C in cooperation with the states and through the state agriculture colleges. It has greatly benefited farm people in particular and the people of the United States in general.

This cooperative extension service takes science to the farm and the farm home and helps farm people apply it. It works largely through extension agents who are now located in every important agricultural county. These agents have studied the science of farming. They live in the community and help the farmers put the findings of science to work.

TEAMWORK WITH THE COUNTY AGENT



The farmer and the county agricultural agent often work together in carrying out farm improvement. Here a farmer left and a county agent examine the roots of a clover plant. The farmer has planted clover in one of his eroded fields.

Cooperation with these extension agents is entirely voluntary. But farm families have learned that it helps to know what science has found for developing a balanced farming program. By using these methods the farmer knows he can earn the best living for his family and get the best production from his land. More and more farm people are cooperating with the extension workers. Today more than a million rural men, women and girls and boys are serving without pay as voluntary local leaders of extension work.

Two of the most important of the extension workers are the county agricultural agent and the home-demonstration agent. The county agricultural agent is a trained agriculturist. Whenever called upon, he aids the farmer in obtaining and putting to work information on crop growing, soil testing, putting weight

A MEETING OF A COUNTY FARM ORGANIZATION



At county farm organization meetings farmers discuss ways of improving farming methods. Local farm organizations often belong to a national federation. These national organizations help farmers solve business, social and educational problems.

GETTING COOKING TIPS FROM A HOME-DEMONSTRATION AGENT



Here a home-demonstration agent is giving tips on making cooking easier and food more attractive to a group of county home-demonstration club leaders. They will return to their own communities and pass on the cooking suggestions to local club members.

ment from the standpoint of better homemaking, better housing, better clothing, balanced diets, and the latest methods of canning and preserving food. She also works with them to improve the community by stimulating families to think more carefully about home and world problems. She aids them in getting better rural library services. And she helps with community recreation, such as plays, and social gatherings.

The county agricultural agent and the home-demon-

stration agent help 4-H Club boys and girls with farm improvements. They study the best ways of raising livestock, producing and conserving food, and improving clothing and houses. They also learn the importance of soil conservation and the importance of preventing fire and accidents as they participate in their numerous constructive projects.

on livestock, controlling bugs and pests, and marketing. And often the farmer supplies a particularly valuable tip on farm improvement that the county agent can pass on to other farmers.

The home-demonstration agent is a woman trained in home economics. She works with farm wives and daughters and cooperates with them in farm improve-

ment from the standpoint of better homemaking, better housing, better clothing, balanced diets, and the latest methods of canning and preserving food. She also works with them to improve the community by stimulating families to think more carefully about home and world problems. She aids them in getting better rural library services. And she helps with community recreation, such as plays, and social gatherings.

Farming as a Business

THERE ARE still many small farms on which one man and his family do all the work in the true pioneer tradition. But for the most part farming has become "big business."

Just as in modern industry, modern farming calls for special skills and up-to-date methods. The successful modern farmer cannot go on farming as his father did. Many farm youths take agriculture in high school and college. They also study in extension courses and farmers' institutes. And study does not stop with graduation. The successful farmer continues to read and study as long as he farms. He may take short winter courses at his agricultural college (See Agriculture.)

The successful farmer must be a good manager. He must plan his year's work well, keep accounts, often hire one or more workers to assist in the production of crops and animals for marketing, and know how to sell his products wisely.

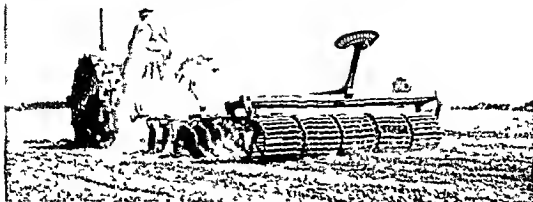
The farmer as a good businessman must try to raise crops and stock that will bring a favorable price. Prices for farm products may change greatly in a short time. But the farmer cannot change his plans much after he seeds his crops and begins raising young

animals. If feed prices jump, his fattened hogs and cattle may cost him more than he receives for them. He must try to forecast the selling prices for farm products, just as a clothing manufacturer must forecast future buyers' needs.

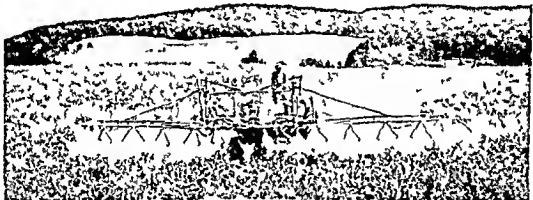
A good farmer uses each part of his ground to the best advantage. He turns rugged, rocky acres into pastures. He rotates crops so that one greedy crop, such as corn, cotton, or tobacco, does not sap all the minerals from a field. He sows clover, alfalfa, and other plants to increase the soil's fertility. He spreads manure and commercial fertilizer on worn soil. To keep the topsoil from washing away, he may plow sloping fields along their contours. Sometimes he plants alternating strips of crop and clover. The clover helps hold the water and enriches the soil. He repairs gullies by planting bushes or other vegetation with tough roots to hold the soil. (See also Soil; Conservation.)

Much of the farmer's success depends upon his wife. It is she who can aid in creating and maintaining a well-balanced household, which is a very important part of the well-balanced farm. The county agricultural agent and the home-demonstration agent assist

FARM MACHINES THAT DO THE WORK OF MANY MEN



This field is being prepared for planting with wheat. By attaching two machines in a row to his power full tractor the farmer is doing two jobs at once - shallow disk and rolling his field. The disk and roller break up the soil making it fine and loose for seed ing.

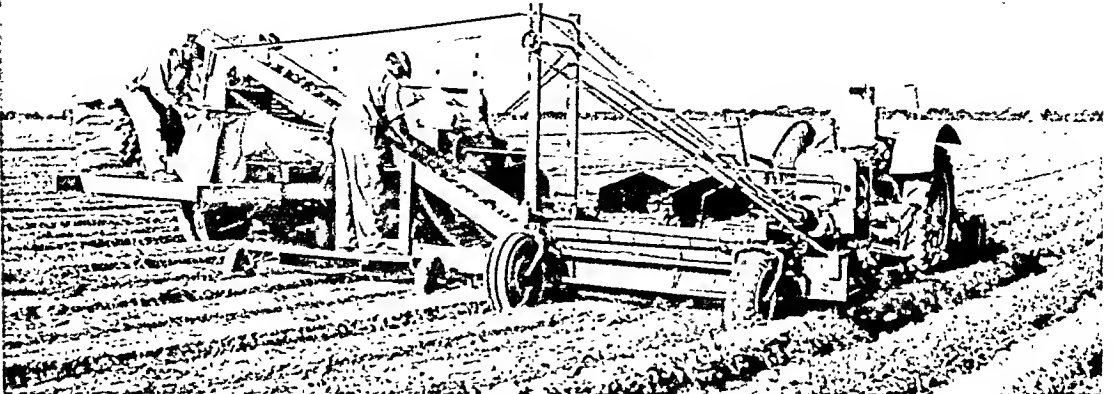


After a crop is planted and begins to grow one of the farmer's biggest jobs is to keep insects from destroying the young plants. Sometimes insecticide is sprayed by hand. On large farms however machines do the work. Here a farmer is spraying dusting a good field.

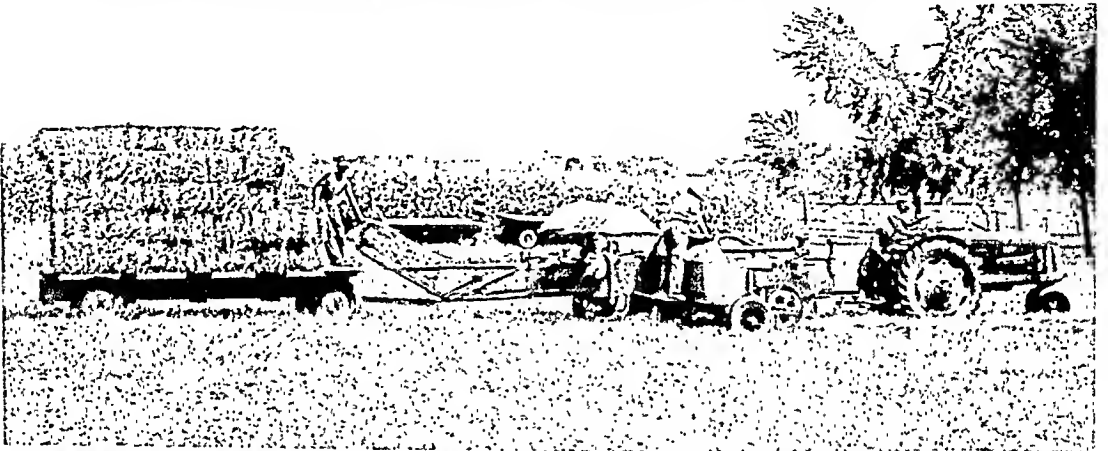


Weeds are a serious problem for every farmer. In this picture you can see the work of a weeding cultivator. The same machine does the weeds but does not hurt the tough cotton bolls. The farmer saves on the price of a hoe because the machine is so high. It comes out of the rows at the side of the rows killing the weeds in the corners where the power cut the weeds from between the rows.

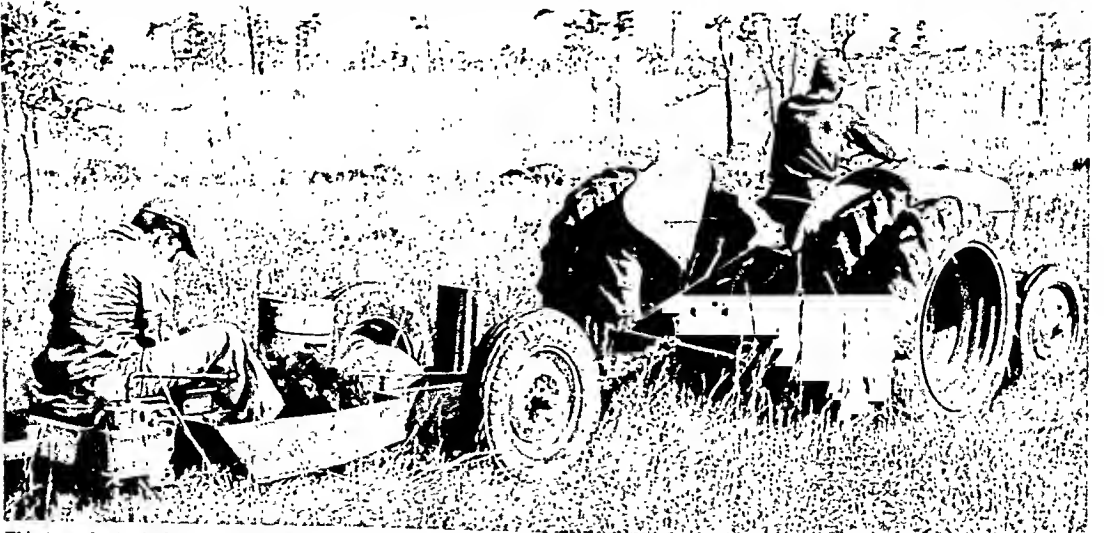
DIGGING POTATOES, BALING STRAW, AND PLANTING TREES



On many farms this machine has done away with the slow, hard task of digging potatoes by hand. It travels along the plant rows, digs up the potatoes, knocks off the dirt, and carries them up the elevator at the left, where the man is sacking them.



When oats are harvested, straw is spread on the fields by the combine. Later it is picked up and baled by a hay baler, as pictured here. The bales are stacked on the wagon and hauled to the barn, where the straw is used for hedding down the farm animals.



This tree planter is fitted with a plow which cuts a narrow slit in the soil. The operator of the planter places seedlings in the slit. The machine then closes the slit to hold the seedlings firmly. Using this machine, two men can plant seedlings on ten acres a day.

both the farmer and his wife in working toward their goal of successful farming and successful farm life

Using Laborsaving Machinery

It is hard for the modern farmer to get skilled dependable farm hands. Young workers often prefer city jobs with shorter hours, higher wages and city amusements. The farmer uses laborsaving machinery in place of extra help. These machines cost a lot, and the farmer must figure carefully to be sure they will pay their way. For example, a man with a small potato patch does not need an expensive mechanical potato digger.

The tractor is the most helpful laborsaver. Its powerful engine pulls many farm machines—plows, harrows, seed drills, cultivators and harvesting machines. Its high wheels with big thick treads can run ble over almost any rough or muddy surface. Its engine can work as a stationary motor to operate saws, feed grinders, silo fillers and other machines.

Electrical equipment helps in many ways. Electrical pumps, milkers, grain grinders, paint sprayers, hay driers and hoists are laborsavers. The farm truck saves time in hauling produce to the market and bringing back supplies from town.

Different Kinds of Farms



Dairy farms are noted for the clean, well kept look. A part of the herd of dairy cows may be seen in the field. In the background are the neat, white dairy barns, milking sheds and silos. To the left of the roadway is the farmhouse. Its yard is enclosed by a picket fence.

THE KIND of climate, rainfall, soil and amount of level or hilly land help decide what kind of farming will pay in a region. Farmers also consider the available markets and how they can transport the output.

Farms vary in size. Farm land is usually measured in acres. In the early days of the nation the land west of the Allegheny Mountains was surveyed in mile-square sections (see Lands Public). Each section contains 640 acres. So farms in this region are likely to contain a quarter or a half section.

Vegetable farms on valuable land near cities may contain only 20 acres or less. But on the Great Plains stockmen pasture cattle and sheep over thousands of acres. Large wheat farms may stretch for miles.

Some farmers specialize in a single crop such as cotton or wheat. They sell the cotton or wheat and buy food and other things they need. Other farmers called *general farmers* raise a variety of crops and stock and grow most of their own food.

A Typical General Farm

General farming is the type of farming, mainly discussed in previous sections of this article. It is also called mixed or diversified farming and goes on in many parts of the country. The best-known region for general farming is the corn belt (see also Corn). This fertile area stretches across the country's central lowland (see United States section, North Central States). It is the largest area that is closely cultivated. Its fields look like a giant checkerboard from the air. Market towns lie every few miles along the good, straight roads and railroads.

Most general farms are of moderate size, averaging 160 acres or a quarter of a section. In the Middle West corn is the basic crop. The farmers usually feed the grain to hogs and cattle and make their money by selling the animals. They may sell other produce such as wheat or rye. A vegetable garden, a flock of chickens and a cow or two take care of a large part of the family's food needs. The housewife preserves vegetables, berries and fruits by canning, drying or quick freezing them. She puts a store of hardy vegetables in a cellar or pit for family use during the winter months (see Food Preservation).

Dairy Farming

Dairy farms are usually located within a few hours' truck or train haul from cities. The chief dairy belt stretches from New England and New York westward to Minnesota and northeastern Iowa. This area furnishes whole milk for millions of people to drink. Many creameries, condenseries and cheese factories in the section also buy the cream and milk to manufacture butter, cheese and condensed and powdered milk.

It is often said that the dairy farmer is chained to his cows. The cows must be milked morning and evening, rain or shine, because the milk fills the cows' udders and gives them great pain if they are neglected. But the dairy farmer is repaid for the close routine of this work. He gets regular monthly pay checks for the milk and cream instead of having to wait to sell a crop at harvest time.

Dairy farmsteads have big barns and silos. Electrical milkers and other equipment and machinery

have lightened the work of the dairy farmer. But if his herd is large, he may have to hire extra help unless his children are grown. His wife may help care for the milk and sterilize the equipment in the milk house (*see* Dairying; Milk).

Between milkings the farmer cleans the barn and works in his meadows and fields. He keeps the land rich by fertilizing it with the manure from his cows and from other farm animals. He may raise hogs and chickens if he sells only his cream and has the skim milk to feed the stock.

Dairy farmers work constantly to improve their herds, coöperating with expert testers from agriculture colleges much as the general farmer coöperates with the county agriculture agent.

The Wheat-Belt Farm

The wheat belt lies west of the corn belt, mainly in the first tier of states west of the Missouri River (*see* Wheat). It has level and rich land, but the climate is too dry for general farming. Wheat farms are large, ranging from half a section to several sections. Grain fields stretch to the horizon. Houses are scarce and neighbors live far apart. In the scattered towns, tall grain elevators tower over a few houses and small stores.

Wheat is drilled in close rows and covers the ground. The fields do not need cultivating, so the wheat farmer has only two big jobs: planting and harvesting. Some men in the winter-wheat belt visit their farms in the fall to plow and seed, and do not need to return again until harvest time the next summer. They are sometimes called "suit-case farmers."

The wheat belt hums with work and excitement at harvest time. When the grain heads grow heavy, the farmer knows that he must harvest them quickly or lose some of the grain. Members of the family take turns driving the tractor day and night, pulling the combine that cuts and threshes the grain (*see* Threshing). Several farmers may band together to "combine" one field after another. Or they may hire custom combine teams that move through the wheat belt with their equipment as new fields are ripe.

If the crop is big, and wheat prices high, the farmer makes a good living without working as hard as the general farmer. But drought, hot winds, or insects may destroy his one crop. Many wheat farmers, therefore, raise cattle also. The animals can crop the young wheat sprouts in the fall and spring without damaging them. To get feed for the rest of the year, the farmer raises drought-resistant fodder crops, such as kafir or other sorghums (*see* Kafir; Sorghum).

The Cotton Belt

Most farmers raise food plants or animals, but thousands in the South and parts of the West specialize

in raising a fiber. This is cotton from which clothing, bedding, and the like are made. The cotton plant requires hot weather, moisture, and fertile soil. These conditions prevail in a vast crescent of land curving from eastern North Carolina across the Mississippi River into Texas and Oklahoma. In the Far West,

HARVESTING A COTTON CROP BY HAND



Although cotton-picking machines are widely used in the cotton belt, much of this fluffy white crop still must be picked by hand. Here two workers go down the rows, picking the bolls and putting them in their huge harvesting sacks. Later the crop will be loaded in trucks or wagons and hauled to the cotton gin.

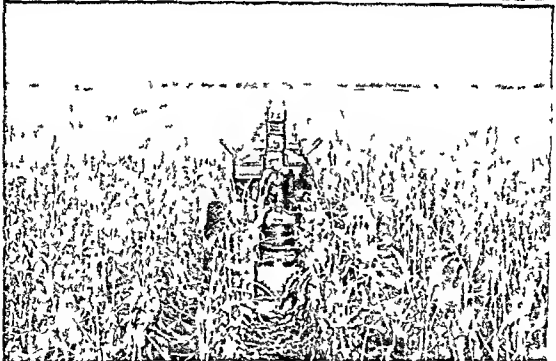
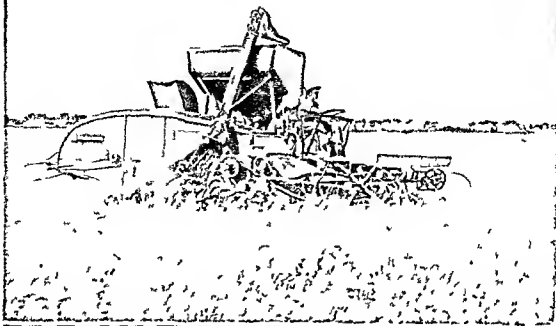
California also is one of the country's leading cotton-producing states.

The cotton plant saps richness from the soil and demands much labor from the grower. Its seeds are sown thickly and in rows. The farmer must chop away the extra sprouts in the rows and the weeds from between the rows with a hoe. If it is a large cotton farm, a machine may be used to kill weeds. In many areas the farmer must spray the fields with poison to kill destructive boll weevils (*see* Cotton; Weevils).

In the late summer or fall the cotton plant's pods or bolls ripen and pop open. Then the farmer and his helpers go up and down the rows many times, picking the fluffy cotton. The owners of the large cotton farms use tractors and special machines to plant, cultivate, and even pick the cotton.

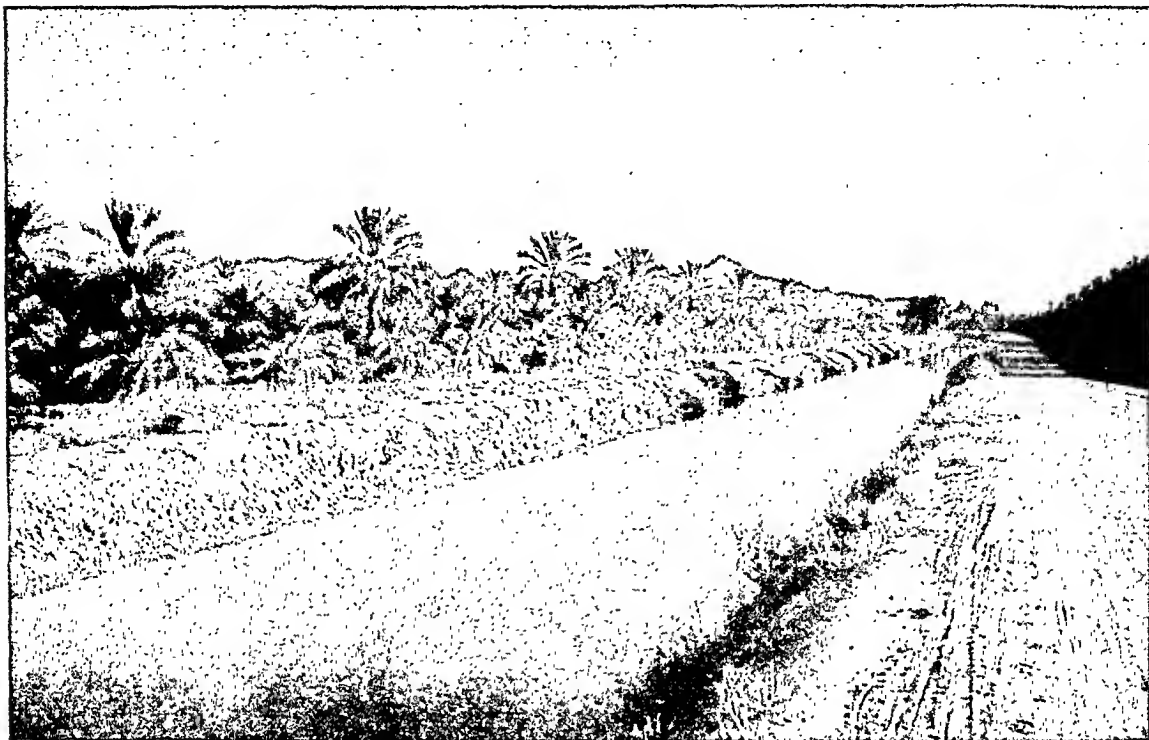
Many cotton farmers are share croppers or tenant farmers (*see* Cotton, subhead "Tenant Farming"). They cultivate land belonging to a plantation owner and share with him the money from the crop. In 1937 the Farm Tenant Act was passed in an effort to help tenants buy land and become independent

HARVESTING AMERICA'S TWO MOST IMPORTANT GRAIN CROPS



In the top picture one man operates a self-powered combine as it cuts and threshes a big stand of wheat. Many combines are pulled by tractors. Bottom: a man operates a corn picker. This machine strips the stalks and husks the ears along two rows of corn at a time. With this modern machinery each man is doing work that would require a crew of harvesters if done by hand. Corn and wheat are America's two most important grain crops. More land is used to grow them in the United States than all of her grains put together.

FRUIT FARMS FLOURISH IN THE SOUTH AND WEST



In the hot, dry southwestern United States there is not enough rainfall for anything but desert vegetation. The soil, however, is very fertile, so when water is provided crops flourish. The date farm, top, and many more thousands of acres receive water from an irrigation ditch. This is in the Salt River project near Phoenix, Ariz. This great irrigation project provides water for more than 200,000 acres. Pictured at the bottom is a grapefruit farm typical of those located in Florida, Texas, Arizona, and California.

cotton farmers Through the Farmers Home Administration more and more ambitious tenants and share croppers are becoming successful cotton farmers (see Agriculture Cotton)

During the midsummer and midwinter lulls in their work cotton farmers and their families have

have a stream or natural water hole he drills wells and sets up windmills to pump water to fill troughs for the thirsty cattle

The Horse Is Still King

Horses are being replaced by tractors on crop-growing farms But they are used as much as they ever

DRIVING CATTLE TO MOUNTAIN PASTURE



Here a cowhand brings part of a herd of cattle from the ranch to summer pasture on a grassy mountainside. Each animal bears the rancher's brand. The cowhands recognize their cattle by this sign when they round up the herd and return it to the ranch in the fall.

time for picnics watermelon feasts fish fries revival meetings fishing hunting and visiting They enjoy Saturdays in town and trips to the cotton gin to market the crop

Tobacco Farming

The tobacco farmer is another specialist who grows a crop not used as food Like cotton this plant robs the soil of its minerals which have to be replenished Tobacco farming requires much hard work by the farm family Their jobs include sowing seed in a bed transplanting cultivating topping working spraying harvesting and curing (see Tobacco)

Ranches in the Great West

In the Far West rainfall is so scanty that farmers cannot raise crops without irrigation But grass grows on millions of square miles of land This makes ideal pasture for cattle and sheep (see United States sections 'Great Plains Rocky Mountains and Western Basins and Plateaus')

Ranches are much larger than the farms to the east The average ranch in Texas and New Mexico has more than 30 000 acres Towns may be a hundred or more miles apart Only the main highways are hard surfaced The ranch buildings may stand beside an unpaved road many miles back in the wilderness Many ranchers have their own airplanes for transportation

On a big ranch there is a house for the owner's family a bunkhouse and a cookhouse for the cowboys a barn and a corral Range cattle are not housed in barns The big herds of hundreds or even thousands of cattle may stay on pasture the year round If a snowfall covers the grass for any length of time the rancher must supply hay He must provide water in every part of the range In localities which do not

were in the cattle country Ranchers and cowhands are constantly in the saddle They ride over the ranch to see that the fence is sound and that the cattle have not strayed When their herds feed with other cattle on unfenced range they must look after their own animals and bring them home at roundup time Each animal can be identified by the ranch brand seared on its hide

A favorite sport on ranches is the neighborhood rodeo This may be a calf roping bronco-riding or other cattle-country contest in which local cowhands participate (See also Cattle section When Cattle Ruled the Western Plains)

Some ranchers specialize in raising sheep In summer they may drive the flock far up into the mountains to graze A shepherd and trained sheep dogs go along to guard them against coyotes and other wild beasts The shepherd lives in a camp or in a covered wagon equipped with a bed and cookstove Work at a sheep ranch includes caring for the new born lambs dipping the animals in a chemical to kill insect pests and shearing wool from the sheep (see Sheep Wool)

Fruit Orchards Groves and Vineyards

The location of fruit groves and orchards depends largely on climate Citrus fruits—oranges grapefruit and lemons—flourish only in the warm South in California Texas and Florida The hardier fruits are scattered over the country from the huge apple orchards of Washington's irrigated uplands to the peach orchards of Georgia (see Fruits)

Grape farms are called vineyards Their operators must prune the vines and train them on stakes or trellises Harvest brings a busy season and extra pickers

CANTALoupES GROW IN A "TENT VILLAGE"



This "village" of miniature tents is a huge irrigated cantaloupe farm in the Southwest, where nearly all our early cantaloupes are grown. The truck farmer has covered the tender young plants to protect them from frostbite. When the plants get larger, insects will be a problem.

are needed (see Grapes). Melons and berries are other special crops grown on truck and fruit farms. Groves of nut trees also bear big crops of almonds and walnuts in California, Oregon, and Washington. Most of the cotton-growing states produce pecans.

Raising Vegetables for Market

Millions of town and city people need huge quantities of vegetables and fruit. Many farmers have turned to truck farming and fruit growing to meet these needs. Most cities have truck farms near by. The biggest vegetable sections are the low eastern Coastal Plain within easy shipping distance of scores of cities, the warm, well-watered Southeast, and the irrigated valleys of the warm, dry Southwest. The warm areas produce vegetables and fruit in the winter when northern farms are covered with snow. In these sections farmers often raise more than one crop a year.

Farmers in the Southwest do not get enough rainfall to make the crops grow. They must pay to have water brought to their fields and orchards. Huge reservoirs store the melted snow water from the mountains in the spring and early summer. Throughout the year irrigation systems supply water to the farms through canals and ditches (see Irrigation and Reclamation).

Truck farmers try to make every square foot of their land pay. Vegetable growing requires much work. Many plants are seeded in greenhouses, or glass-covered beds, then transplanted in the ground out-of-doors. Weeding and thinning are usually done by hand. Harvesting and packing the vegetables, berries, and melons for market take the work of many hands. Farmers and fruit growers must hire

extra workers for the harvest. The pickers move from place to place to work as the crops ripen. These migratory workers live in camps at the place they are working. Often they have no settled homes.

Many big truck farms and orchards on irrigated California land are owned by companies and are run like big factories. Their year-round employees work regular hours for wages. These workers may live in

near-by towns or in dormitories or rows of houses on the farm. Large farms have special machines designed for vegetable planting and harvesting.

Varied Specialty Farms

Many kinds of specialized farming are needed to supply America's food. Part of the sugar supply is imported, but the country has thousands of sugar-beet and sugar-cane growers. Cane farms lie along the Gulf of Mexico, where the growing season is long and rainfall abundant. Sugar beets need a shorter, cooler growing season. They are raised farther north, especially on irrigated farms in the West.

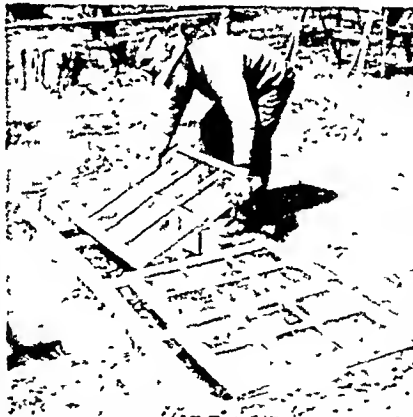
Rice farmers plant their seed in moist, warm parts of the country. Rice grows in water, so the farmers must flood their fields

They drain off the water at harvest time, so they can cut and thresh the grain with combines (see Rice).

Poultry Farms in Many Regions

Poultry farms are found all over the United States. Many lie near cities for convenient delivery of eggs and fowls. A man with small capital may take up chicken raising, since he does not need a large farm. "Battery raised" chickens do not leave their poultry houses. They live in tiers of wire-bottomed cages, flooded with ultraviolet light to keep them healthy and speed their growth (see Poultry).

BUILDING A COLD FRAME



A farmer builds a cold frame for starting garden plants in early spring. The plants get the sun's heat through the glass, which also protects them from frost. By starting plants in a cold frame and later transplanting them outdoors, the farm family gets vegetables early.

FARRAGUT, DAVID GLASGOW (1801-1870) The ranks of rear admiral, vice-admiral, and admiral of the United States Navy were created successively to reward the services and acknowledge the genius of this great American naval hero. His captures of New Orleans and Mobile find parallels only in Nelson's victories of Copenhagen, the Nile, and Trafalgar, for battles between modern naval vessels are not comparable to the fighting of Farragut's day.

Farragut was born on July 5, 1801, in a pioneer cabin near Knoxville, Tenn., of a Spanish-descended father and a Scottish mother. His father's friendship with Commodore Porter brought the boy an appointment as midshipman before his tenth birthday. The United States Naval Academy was not established until 1845, so cadets were educated and trained at sea.

In the War of 1812 Midshipman Farragut sailed with the *Essex* on her famous cruise to the South Pacific. He took a prize ship into Santiago, Chile at the age of 12, and conducted himself with coolness and courage in the terrific battle with two British frigates in which the *Essex* was sunk. Forty-five years of routine duty followed. During this period he established the naval station at Mare Island, San Francisco.

When the Civil War came, Captain Farragut was in his 60th year. Although of southern birth with a Virginian wife and home, he decided that his allegiance belonged to the Union. He was given command of a superb fleet of heavy ships, gunboats, and mortar boats and was ordered to open the mouth of the Mississippi by taking New Orleans. The way up the river was defended by two forts, between which stretched a heavy iron chain. Farragut burst the chain, ran his fleet past the forts, evaded a fire ship, sank the defense fleet, and captured New Orleans.

For 16 months more he saw exciting service on the Mississippi, aiding materially in the taking of Vicksburg. So continuously was he under fire that he won the nickname of "Old Salamander." Then he was ordered to take Mobile, the last stronghold of the Confederates on the Gulf. The entrance to the bay was

DAVID GLASGOW FARRAGUT



Farragut was the first admiral of the United States Navy. His office was created for him on July 26, 1866.

protected by Forts Gaines and Morgan and the channel was filled with torpedoes. Nevertheless, within three hours after the first gun was fired in Farragut's attack, the Confederate flag was hauled down (Aug. 5, 1864). It was at the crisis of this battle, when the Union fleet was on the verge of defeat, that he uttered his famous saying: "Damn the torpedoes! Go ahead!"

This was his last naval service. He now asked to be relieved from active duty and settled in New York City. Great celebrations were held in his honor, and for the six remaining years of his life he enjoyed honors such as have been accorded to few Americans.

The LAST FRONTIER—America's Greatest ROMANCE

FAR WEST. More than a hundred years ago the American novelist James Fenimore Cooper wrote his "Leatherstocking Tales." The boys and girls of his day thrilled with the adventures he described in "Deerslayer," "The Last of the Mohicans," and the other stories of the series. He was writing about the Far West, and the life of Indians, hunters, and pioneers, and he laid his scene in central New York, for that was where the West of that day began. About half a century later, Mark Twain wrote "Roughing It," and Bret Harte wrote "The Luck of Roaring Camp." They too described the West and the men and women who wrestled with it and settled it. But these writers found the West in the valleys of the Rocky Moun-

tains and in the mining camps of the gold fields. They told romantic stories, which Americans loved to read and which readers in Europe welcomed, for it seemed to them that this West was the most picturesque thing in all America.

In 1887, one who had spent many years along the border took a living sample of it to England where it was the great success of an imperial exposition. This was Buffalo Bill (Col. William F. Cody), whose Wild West Show had made its first appearance in 1883, and was to make its greatest triumph in 1893 at the World's Columbian Exposition in Chicago. But the Far West that Buffalo Bill knew as express rider, scout, soldier, hunter and showman was gone by

1893, never to return. It remains one of the pictures from the American past, always full of excitement and of real importance.

At the close of the American Revolution, after independence had been won, the United States was a seaboard nation, with the Mississippi River as a western boundary. Pioneer settlements were spotted over the country from Pittsburgh to St. Louis. The rivers carried the canoes of the prospectors and the flatboats of the settlers into the wilderness. The cabins of the frontiersmen appeared in the clearings in the forest, and the clearings grew and spread until broad and fertile fields became common everywhere. There was so much work to be done making new states east of the Mississippi that there were few who cared much about what lay beyond.

The Beginnings of the West

Thomas Jefferson was one of the few who did care. Immensely curious, he wanted to know just where the Rocky Mountains were, for none of the maps were accurate. He knew that the vast Missouri emptied into the Mississippi from the west, just above the mouth of the Ohio; but no one could tell him from where it came. In 1803 he appointed Meriwether Lewis and William Clark to lead an expedition to find the answers. But before the explorers set out, France unexpectedly offered to sell the whole of Louisiana, as the country west of the Mississippi was called. Jefferson quickly bought it.

In 1804-5 Lewis and Clark led their expedition up the Missouri River to its source across the Rocky Mountains and down the Columbia River to the Pacific. They brought back an account of the Far West that lay beyond the West that Jefferson knew. And until the century was nearly over, this Far West was a stubborn stretch of nature that would not respond to the same treatment that had conquered the Middle West and the eastern settlements. It was tamed only when the railroad was built across it, the windmill brought water to its treeless slopes, and the wire fence defined property rights on its otherwise almost boundless ranges.

Lewis and Clark returned from their explorations in 1806, and there were already under way other efforts to find out what it was that Jefferson had bought. In the previous winter, a young lieutenant in the army, Zebulon Montgomery Pike, had been sent up the Mississippi River from headquarters at St. Louis to ascertain the source of the great river. He did not find the real source, which is in a district of lakes and swamps, for the whole region was under thick ice and heavy snow. But he brought home much information about the country above the mouth of the St. Peter's, or Minnesota River. In the summer of 1806 Pike was sent out again, this time to find the sources of the Red River and the Arkansas. Again he found neither, but he saw the great peak which has come to be known as Pikes Peak, and he visited the place where the Rio Grande rises in southern Colorado. Here he was arrested by Spanish soldiers, for he was trespassing on their territory. Nothing west of the Rio

Grande could upon any claim be treated as a part of Louisiana. He was escorted—half prisoner, half guest—through New Mexico, the northern provinces of Mexico, and Texas. In 1807 he was returned unharmed to the American army post at Natchitoches. His book, which was published a little later, aroused the ambition of traders on the Missouri border to visit Santa Fe and capture the markets of the Spanish settlers.

The general dimensions of the Far West were now known, but there was no rush of settlers to occupy it. Louisiana became a state in 1812 and Missouri in 1821. Three more states along the Mississippi River, Arkansas (1836), Iowa (1846), and Minnesota (1858), came in due time. West of Missouri there was no serious move for a new state until after 1850. All this time the United States accepted the verdict of the early explorers, and of Stephen H. Long, who crossed the plains in 1819-20. Their opinion was that farmers would not be able to make permanent settlements in the country west of the first row of states along the Mississippi. There were few trees to use in building homes, and rainfall was too scanty to grow crops. In some places the land was rocky and mountainous; and elsewhere there were sand and sagebrush that constituted real desert. It was featured in the school books as the Great American Desert. It teemed with wild game, with the buffalo herds that grazed their way up the plains each spring and down again each autumn, and with other animals whose numbers aroused the excitement of all who visited the region. There were Indians too who followed the roving herds with fleet ponies descended from the animals the Spanish explorers had turned loose or lost. The farming frontier developed east of the Mississippi and in the first tier of states west of it, but the Far West was left to native Indians and wild game until long after the great migration had peopled the Ohio Valley.

Missionaries and Fur Traders

Long before American explorers drew their picture of the Far West the country had been known to the French and Spanish. Missionary explorers and soldiers had visited it many times, and traders had come, tempted by the profits of the fur trade. From New Orleans they had worked up the river to St. Louis; and from St. Louis they reached out toward the Rocky Mountains, inducing the Indians to bring in furs, and sending out trappers to collect them. They had come too from Quebec and Montreal and from the shores of Hudson Bay. Their runners, who scoured the plains and searched the mountains for good trapping sites, knew many details of the land long before the surveyor arrived to map it.

When the Far West became part of the United States, Congress tried to drive out foreign trappers, particularly those of the Hudson's Bay Company, and to protect the traffic for Americans. John Jacob Astor, a New York merchant, took the lead in organizing American fur companies. Stockaded posts were built for agency houses, where trade with Indians was

carried on. Each year goods for the Indians were sent to the posts. The items included blankets, guns, powder, tools, needles, beads, and all the trinkets the Indian lacked and wanted. And after the winter hunt, the western tribes journeyed to the posts to trade their furs. Out of the posts, white traders and half-breeds, who were the children of white traders and Indian wives, traveled to the fur country with pack trains of trading goods. Around many of the posts, the cabins of these trappers, with their families and children, made the beginnings of white occupation. From 1812 until 1846 the fur trade was the chief resource of the Far West. It seemed so permanent that Congress decided to use it as the foundation of a permanent Indian policy, and while Jackson was president the "Indian country" was created (*See Furs and Fur Trade*).

Disposing of the Indians

It had become a hard problem to know what to do with the Indians. Since the beginning of settlement they had given way in the face of the advancing cabins of the pioneer farmers, moving always west. The states wanted them removed from their borders. White communities did not like Indians near by. By 1821, most of the area available for states had been used, and there remained for the Indians little more than the high plains and the so-called American desert. President Monroe recommended that the Far West, beyond the western boundary of Missouri, should be devoted permanently to Indian use. For 15 years, after 1825, with the full approval of Congress, the tribes were given homes on the new Indian frontier. Laws were passed to protect them from encroachment. An Indian Bureau was established at Washington to look after their needs, and a special regiment of cavalry was organized to police the border. The native Indians of the plains were persuaded to welcome as neighbors the emigrant Indians who were moved to the border from their eastern homes.

The Indian country, as it was called by law, was neither state nor territory, but a place where the Indians were colonized under special laws for their welfare. This region stretched from the Red River to Canada, and from the western boundary of Missouri to the Rocky Mountains. But it was dismantled as the years went on, for it was found that the notion of the American desert was largely a myth, and no effective means was ever found by the government at Washington to keep white travelers, traders, and settlers out of the portion of the West allotted to its Indian wards.

The farmer pioneers did less to upset the security of the Indians of the Far West than did the overland trails. For 20 years after 1830, thousands of home

seekers and adventurers followed these trails from the settled regions of the United States to the Rocky Mountains and the Pacific coast. When Louisiana was bought, its western boundary along the Continental Divide was the westernmost limit of American territory. To the northwest lay the Oregon country, valued for its furs and as a way station for ships in the China trade. To the southwest was California, dotted with Spanish missions. Around them grew little colonies of Indians, retired soldiers, and traders. Neither region lay within the range of probable expansion as yet. But before Jackson became presi-

BESIDE A TRAPPER'S CAMPFIRE WITH KIT CARSON



This old print shows Kit Carson, one of the West's most famous trappers and guides, seated on a log, talking to other trappers around a campfire. Such men spent their lives roving the wilderness. Their knowledge of the land made them excellent guides. Notice the traps at the end of the log.

dent, occasional trappers had crossed the mountains and discovered the charms of the Willamette Valley and the California country.

Oregon was subject to claims of both England and the United States and was held in joint occupation until the owners could agree how to divide it. It came into the American view when in the early 30's the trappers began to send parties up the Missouri River and the Platte and into the valleys of the Columbia. Missionary societies developed an interest in the Indians. The famous Marcus Whitman took his bride to the mission farm at Waiilatpu. An Indian agent went out from Washington in 1842. In the spring of 1843 there gathered near the bend of the Missouri River, on the eastern edge of the Indian country, more than a thousand home seekers who were determined to risk the nine months' overland trip for the sake of farms in Oregon. In 1846 England and the United States divided the Oregon country along the line of 49° north latitude, and the overland trails took on new importance.

To the Indians the trails were a calamity, for they earned thousands of white men into the Indian country and dispelled the illusion that the Far West was a desert. But to the farmers of the Middle West they

were the channel of the greatest long-distance migration in American history.

Most Famous of the Trails

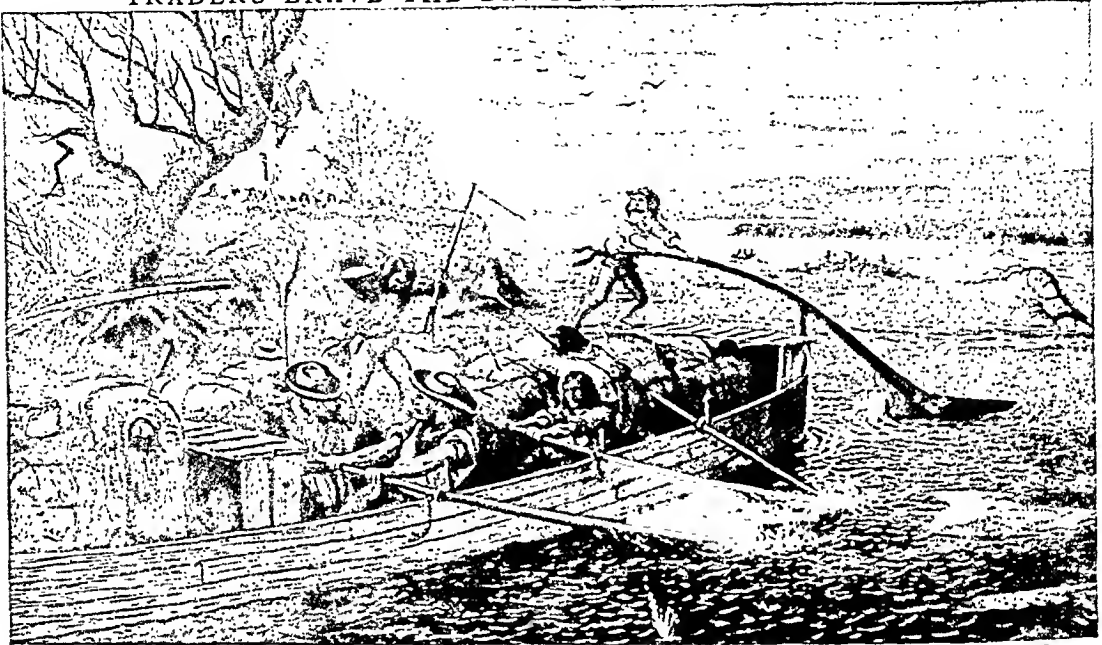
The Oregon Trail was the route of the emigration of 1843 and was the most famous of all the routes. Francis Parkman, the great historian, visited it while it was new and described it in a book that is still

the wagons made an enclosure into which the cattle were driven for the night. Thus enclosed, they could be neither stampeded nor stolen by the Indians.

The Course of the Oregon Trail

The main highway, well trodden by 1846, left Westport Landing, or Independence, at the mouth of the Kansas, and ran across country to the Platte River,

TRADERS BRAVE THE DANGERS OF THE MISSOURI



Bands of hostile Indians often attacked the fur traders who ventured up and down the swift, snaggy rivers of the West. Here an old print shows a group of traders on the Missouri struggling to defend themselves and their flatboat from flying arrows.

famous, 'The Oregon Trail'. It began, where most of the trails began, at that stretch of the Missouri River where the stream turns sharply eastward at the mouth of the Kansas River. Roads from the east crossed the Missouri River at many places above the mouth of the Kansas, but the "great bend" of the Missouri was the chief starting point for trader, soldier, explorer, or emigrant bound west.

Each year, in May, when prairie grass was soft and prairie roads were dry enough to carry loads, the overland emigrants gathered along the Missouri above the bend, completing their outfits at the stores near Independence. Their covered wagons, "prairie schooners," were much like the heavy wagons built by the Pennsylvania Dutch in the Conestoga country on the Susquehanna, and called sometimes "Conestoga" and sometimes "Pittsburgh" wagons. The heavy wheels carried great wooden bodies, and these were covered with canvas tops supported on bows of bent white oak. Drawn by horses or oxen, with families trudging alongside driving the cattle and other livestock, the wagons made up caravans that crawled along the trail. Each caravan was organized under a captain for safety from the Indians. At dusk, the captain directed the wagons to halt in a circular corral, where

at the head of Grand Island. Here was Fort Kearney, built to protect the travelers and to outfit them. The main Oregon Trail followed the south bank of the Platte to the junction of the North and South forks, and then followed the south bank of the North Platte through Mitchell Pass (for picture, see Nebraska) to the mouth of the Laramie River, where there was another of the "service stations," Fort Laramie. A band of religious emigrants, the Mormons, who ascended the Platte in 1847, followed the north bank, which was thereafter known as the Mormon Trail. Both trails merged as one along the Sweetwater branch of the North Platte. Beyond the head of the Sweetwater the wagons crossed the Continental Divide through South Pass, which had been first visited by fur traders about 1823 (see Wyoming). West of South Pass the Oregon Trail followed the Snake River, passing Fort Hall and Fort Boise in what is now Idaho. From Fort Walla Walla the trail followed the south bank of the Columbia to Fort Vancouver. Most of the travelers left the trail here and settled in the Willamette Valley. Some, however, followed the Columbia on to the seacoast. The trail was bordered with the many graves of those who died on the way and with the goods which

were discarded from the wagons as the animals became too worn out to draw heavy loads. There were broken wagons abandoned where they broke and the skeletons of horses and oxen picked clean by the coyotes which howled around the campfires every night and scavenged the campgrounds as the travelers pulled out.

Thousands of people followed the trail into Oregon and in 1848 Congress created Oregon Territory. At the same time many home seekers were moving toward California. These settlers followed the Oregon Trail as far as Soda Springs (in what is now Idaho) but there they turned southwestward to the Humboldt River, the Carson Sink and the Sierra Nevada entry into California. American occupation of the Pacific Slope was begun. (See Oregon Trail.)

The Great Santa Fe Trail

Southwest from the bend of the Missouri the Santa Fe Trail ran across the plains to New Mexico. Here Pike had seen a market in 1807. Regular use of the trail had begun after Mexican independence in 1821 with the wagons crossing the Kansas plains to the great bend of the Arkansas River. The main route ascended that stream to the mouth of the Purgatoire near La Junta in Colorado thence up the Purgatoire (Picket-wire as the illiterate plainsmen sometimes called it) across the Raton Pass and down the slopes to the picturesque old town of Santa Fe. There was a short cut dry and dangerous that crossed the Arkansas near the Mexican boundary at 100° west longitude and ran through the

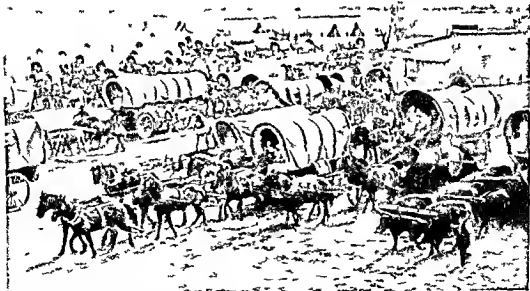
country of the Cimarron River entering Santa Fe from the east. Important as it was the Santa Fe Trail—and its extension to California, the Spanish Trail—was not an emigrant road. It was used chiefly by traders whose prairie schooners full of goods raced across the plains and followed the market down the Rio Grande sometimes crossing the Chihuahuan Desert below El Paso and penetrating as far south as Mexico City itself.

It is probable that the American migrations to California would within a few years have led to an Americanization of the region even had there not been a war with Mexico. As it turned out however war hastened the process. When in 1846 preparations were made to invade Mexico an army was assembled on the border mobilized at Fort Leavenworth (which had been built in 1827 to protect the Santa Fe trade) and marched into New Mexico under the command of Stephen Watts Kearny. From New Mexico Kearny guided by Christopher (Kit) Carson (see Carson) proceeded to Upper California as California north of San Diego was called. When he arrived at Los Angeles he found California already largely conquered by the joint work of the navy and of resident United States citizens and at the head of the latter was the picturesque character of the period of the migrations John C. Frémont.

Frémont the Pathmarker

Frémont was a young engineer attached to the army and was already known as the pathmarker.

SETTLERS BEGIN TO MOVE INTO THE GREAT FAR WEST



In this scene from the motion picture, *The Big Trail*, a huge train of covered wagons sets out from a Missouri River outpost on the hard and dangerous westward journey. Settlers' gunned caravans like this helped protect and companionship.



Frederic Remington
Copyright 1903 by Frederic Remington

'The Fight at the Waterhole', Painted in 1903 by Frederic Remington, Symbolizes the Romantic Tradition of the Far West

and the pathfinder before the Mexican War. In 1842 he had been sent to survey the trail to South Pass. In 1813-41 he had been ordered again to the Far West this time to the Columbia country from which he returned by way of California and a southern trail. West again in 1845 he was on the margin of the Spanish settlements when the Bear Flag Revolt broke out in 1846 and placed himself at the head of the American settlers who cooperated with the army and the navy in the conquest of California (see Frémont).

With the trails in operation the Indian country was doomed. In 1849 the gold rush to the California camps broke all records for migration and active mining camps began calling for government and protection. In the great Compromise of 1850 the Pacific Slope was organized with California as a state and Oregon, Utah and New Mexico as territories. Four years later with the repeal of the Missouri Compromise Kansas and Nebraska territories were cut out of the Indian country reducing the latter to the dimensions of the present state of Oklahoma.

In 1858 the famous overland mail service with coaches running from Missouri to California made its appearance. The traveler in one of these expected to spend nearly three weeks in the cramped quarters of a Concord coach with little sleep and poor food provided at the stations where the horses were changed. In 1860 the Pony Express was run from St. Joseph to Sacramento the riders carrying issue-paper letters in special saddlebags and rushing through on the fleetest ponies the owners could provide. On this service the young Buffalo Bill learned about the Far West. When the electric telegraph supplanted the Pony Express in 1861 Cody turned scout and hunter. He provided buffalo meat for the construction gangs that built the continental railways.

In 1869 the remote sections of the United States were connected by the Union Pacific road and the importance of the wagon trails diminished. In 20 years more the railroads crossed and recrossed the old desert the irrigation ditch made the dry lands bloom. The high plains nearly freed of Indians entered upon their last phase as the cow country.

The Days of the Cowboy

The vast herds of cattle bred in Texas and driven north across the plains to shipping points in Kansas, Nebraska or Montana could never have been profitable before the packing industry was developed to handle their products or before the railroads reached the edge of the plains to carry the steers east to the slaughterhouses. Suddenly about the close of the Civil War the business made its appearance. The cowboys or cowpunchers as the cattle tenders were called captured the imagination of the United States and have held it ever since. Living in the saddle riding the margin of the herds eating from the chuck wagon that accompanied them singing the ballads of the plains and alternating long periods of loneliness on trail with short and wild carousings in the cow towns—Dodge City, Abilene or Ogallala—the cow

boys became heroes of fiction and romance. Around them Owen Wister wrote a western epic. The Virginian. Theodore Roosevelt in search of health bought a ranch and acquired the interest that evoked his *Winning of the West*. And in 1893 from their ranks Buffalo Bill recruited the staff of his Wild West Show whose performances carried the flavor of the Far West to the world outside.

Then at last the frontier disappeared leaving no portion of the earth where such a story could be repeated. New states with farms and cities, high schools and universities, telephones and farm machinery filled out the map of the United States. But the memory of the Far West lingers with romance and adventure. For the United States it is a precious memory. (See also Buffalo Bill, California Cattle Ranching, Lewis and Clark Expedition, Louisiana Purchase, Oregon, Oregon Trail, Pioneer Life.)

FASCISM (*fás'izm* or *fás'izm*) The name fascism was first used for the political system developed in Italy by Benito Mussolini after he rose to power in 1922. It has since been applied to political doctrines elsewhere which in principle or in practice resemble those of Italy's fasci at government.

The term comes from the ancient Romans who gave the name *fasci* to the bundle of rods strapped around an ax which was carried by the lectors or attendants of the higher Roman magistrates. The *fasci* were symbols of authority to flag or put to death. Later the symbol came to represent the strength of the people when united around a central government. In this sense it has been used by many modern nations. You will find the *fasci* stamped on the reverse of some United States dimes together with the inscription *E Pluribus Unum*. Out of Many One.

In Italian the word *fasci* means bundles or units. The small groups which Mussolini organized among ex-soldiers after the first World War were called *fasci di combattimento* or battle units to indicate that they were ready to take up arms again if necessary to achieve their goal.

Aims of the Italian Fascists

What was the goal of these Fascists as they came to be called? They proposed to solve first of all the desperate and immediate problems of postwar Italy. The people were indignant at the peace settlement which gave Italy a smaller share of reparations and new territory than it had expected. Disorder, confusion and poverty reigned. Returning soldiers found no jobs. Strikes without responsible leadership and Communist revolts crippled industry. The government was almost paralyzed. Its leaders yielded first to one and then to another of the many political factions.

To all discontented people the Fascists offered a program of direct action. Drive out the politicians! Put down disorder! Make Italy strong! This was the first simple program, backed by the powerful personality of Mussolini.

How the Fascists for 22 years controlled Italian political and economic life is told in the articles on

Italy and Mussolini. The spirit and fundamental principles of fascism (*fascismo*) grew more out of what Mussolini did to meet Italian problems, than out of theories formulated in advance. The extremes of fascist doctrine, as it later was developed, proved startling, even to many in the Fascist party.

The Doctrines of Fascism

The philosophy of fascism holds that the state is the supreme unit in human affairs. The individual counts for nothing, except as a "cell" in the political, economic, and spiritual life of the state. By himself he has no rights which the state is bound to respect. This is self-evident, says the fascist doctrine, since outside the state's protection the individual is powerless. His freedom of action, his property, his very life are privileges extended to him solely through the power of the state and they may be withdrawn if the welfare of the state requires it. A state so governed is called a *totalitarian* state.

This doctrine is as far removed as possible from the philosophy of democracy with its belief that the power and authority of the state are derived from the will of the people and delegated to their chosen representatives (*see* Democracy). Under fascism, authority begins at the top; the head of the state is the supreme interpreter of the state's will; he is and *must be* a dictator; and such delegation of power as takes place is from the top down. Fascist dictators usually leave property and business affairs in private hands on the ground that the economic welfare of the state is best served by private ownership; but the management of property, business, and finance is strictly and minutely regulated.

How the Dictator Rules

For a dictator to wield so great a power over a whole nation, new machinery is needed. The regular agencies of the state—legislatures, courts, and administrative departments—become means for transmitting advice and suggestions to the dictator and for enforcing his decisions. In addition, special agencies may be set up, like the "labor syndicates," "employers' associations," "state corporations," and "Council of Corporations," which together formed Mussolini's "corporative state" (*see* Italy).

Through his control of the police and the army, a fascist dictator can compel obedience by force. But the fascist doctrine calls for more than mere obedience. The spirit of the people must be shaped to an enthusiastic endorsement of the "national ideals." Fascist governments, therefore, use every device for arousing this enthusiasm. Schools, newspapers, radio stations, public speakers, and other molders of public opinion are forced to become instruments for spreading government propaganda.

Under fascism, "The Leader" (*il Duce* in Italian, *der Führer* in German) not only stands at the top of the government pyramid and of the economic system; he is also head of the fascist organization, part political party and part private army, which brings fascism to power and later suppresses all opposition.

This privileged party-army ("Blackshirts" in Italy, "Storm Troops" in Germany) has been a distinguishing feature of fascist governments.

Fascism in Other Countries

First to be influenced by Mussolini's example was Primo de Rivera, who from 1923 to 1930 attempted to apply fascist methods in Spain. Out of postwar chaos in Turkey rose the dictatorship of Mustapha Kemal Atatürk. Hitler's National Socialism came to power in Germany in 1933, followed by Kurt Schuschnigg in Austria and General Metaxas in Greece. The systems set up by these dictators varied greatly in details of government, but they shared the fascist opposition to democratic institutions. In many other countries fascist parties grew up. Because of its emphasis on nationalism, fascism everywhere strongly opposes international socialism and communism. (*See also* Austria; Franco, Germany; Greece; Hitler, Adolf; Portugal; Spain; Turkey.)

FATES. Human destiny, according to the ancient Greeks, was controlled by three Fates: Clotho, the spinner of the thread of life; Lachesis, who determined the length of the thread; and Atropos, the inevitable, who cut the thread. They were represented sometimes as young maidens, but more often as old and hideous women. Neither gods nor men could escape from their fixed decrees.

FATS AND OILS. One of the ways in which well-fed animals lay by food energy for future use is by manufacturing and storing in their bodies *fats*, including the liquid fats called *oils*. Plants also make fats and store them in their fruits and seeds for the future benefit of their offspring. All fats and oils are of similar living origin. Even the mineral oil, petroleum, has been transformed from animal fats and oils buried ages ago beneath the surface of the earth (*see* Petroleum).

In living creatures, the stored-up energy in fats and oils is held in the form of chemical structures which yield high fuel value when burned in the body. Men use this fuel value in their own bodies when they eat fats or oils (*see* Food). They also use it when they burn oil as fuel in furnaces and engines.

Fats and oils have another chemical property, valuable to living creatures, and also useful to man in many of his manufacturing activities. To remain stored in living tissues, fats and oils must be insoluble in the watery liquids which surround them. Enzymes are required to break them up for digestion (*see* Enzymes). Nature makes use of this waterproof property by putting oil into the skins of animals and the protective coverings of seeds and plants. Men make use of it in paints and many other ways. The physical and chemical structure of fats and oils makes a great proportion of them useful also as lubricants.

Principal Animal Oils

Butter, lard, tallow, neat's-foot oil, various fish oils, and whale oil are among the most widely used animal oils. Lard, the most important of the fats with the possible exception of butter, is the melted

and purified fat of hogs. It is much used in cooking, and in some countries it is eaten with bread. Tallow is melted sheep- or cattle-fat. Formerly used for candles, nearly all of it is now made into oleomargarine. The highest grade of tallow is called "oleo stock"; it is put into presses which separate it into "oleo oil" and the solid "oleo stearin." Tallow and oleo oil are among the most important of the materials used in the soap industry (see Oleomargarine, Soap).

Important Vegetable Oils

Chief among vegetable oils are olive, cottonseed, linseed, corn, soy-bean, almond, coconut, peanut, castor bean, babassu, and poppy-seed oils. Most of them are obtained by pressing the seeds or fruit in special presses, most animal oils are "rendered" that is, extracted, by heating in steam or water.

Oils that have the property of rapidly taking up oxygen when exposed to air and drying with a tough elastic surface are "drying oils." They are important in making paints and varnishes. Linseed oil is most commonly used for this purpose (see Flax, Linoleum, Paints). China wood oil, or tung oil which is used in varnishes, is superior to linseed oil because it produces a harder surface and dries more rapidly. This oil, an extract from the nuts of the tung tree, is mostly imported from China, but the tung tree is now grown in the Gulf States.

"Non-drying" oils do not harden, but gradually decompose and become rancid when exposed to the air, olive oil is an example. These oils are chiefly used as food and in soap manufacture. The most important after olive oil is cottonseed-oil of which the United States furnishes 70 per cent of the world's production (see Cotton).

Corn oil is another important food oil. It is a by-product of the manufacture of glucose and cornstarch, being pressed out of the tiny germ portion of the corn kernel (see Corn). Soy-bean oil has in recent years become one of the most widely used non-drying oils (see Soy Bean). It dries more readily than most oils of this class and is being developed into a partial substitute for linseed oil in paints and varnishes.

Coconut oil is used both as a food and in making soap. About one-half of the supply used in the United States is imported as oil and the rest is pressed from "copra," the dried coconut meat imported from the Philippines, Ceylon, and other points of the Far East (see Coconut Palm). Peanut oil, used chiefly as a salad oil, comes for the most part from China and Manchuria. Olive oil, pressed from olives, is the best of all oils for salad oils and for soap-making, but comparatively little of it is used in the United States because of its high cost. Nearly all the supply is imported from France, Spain, and Italy, where the olives average two to three times as much oil content as do California olives. Much of the oil sold as olive oil is adulterated with cottonseed and corn oils (see Olive). Palm oils, including babassu oil, come from African and South American palm nuts. They are used for food, for soap, and in the manufacture of

template and textiles (see Palm). Castor oil, made from the castor bean, comes chiefly from India. It is valuable in making fine lubricants, soap, and sticky fly-paper, and in medicine (see Castor Bean).

When the oils are pressed from cotton, flax, and other seeds, the hulls are left in the form of hard oily cakes called *oil-cake*, which is ground into meal and used both as feed for animals and as fertilizer. Cottonseed meal, linseed meal, and castor pomace are all rich in nitrogen and therefore exceedingly useful for both these purposes.

Chemically, oils and fats are mixtures of carbon-hydrogen-oxygen compounds, chief of which are *olein stearin* and *palmitin*. These can be decomposed into glycerin and the fatty acids known respectively as *oleic*, *stearic*, and *palmitic* acids. In soap-making oils and fats are boiled with alkaline solutions, the fatty acids combine with the alkalis to form soap and the glycerin is separated as a by-product.

For practical purposes we apply the term fats to substances that are solid at 68° F., and oils to those which liquefy at that temperature. All fats become fluid at comparatively low temperatures.

Essential or Volatile Oils

All the substances so far discussed belong to the group of "fixed" fats and oils. Sharply distinguished from them in origin and character are the *essential* or *volatile* oils. The latter contain in highly concentrated form the odors of the plants from which they come, and hence are largely used for perfumes, flavorings, and in medicine (see Perfumes). Turpentine is one of the commonest of essential oils. Others are the oils of lemon, clove, peppermint, spearmint, eucalyptus, cedar, and bitter almonds.

FAUST (foust) LEGENDS. In the early 16th century there sprang up, first in Germany and later in other countries in Europe, various tales of a magician, Dr Johann Faust, who was in league with the devil, performed marvels with the aid of the evil one, and practised the black art. There seems to be little doubt that a soothsayer of this name really existed (he is said to have died in 1538), but the facts of his life have been lost amid the legends which have crystallized about him. He was represented as a charlatan who traveled from place to place in Germany, living by his wits, and claiming to be a physician, alchemist and astrologer, and a great magician.

Faust first appears in literature in the *Historia von Dr Johann Fausten*, published at Frankfurt in 1587, which contains most of the famous stories told of him. It relates how he sought to acquire supernatural knowledge and power by a compact with Satan. This pact, signed with the blood of Faust, set forth that Mephistopheles, a devil, was to become his servant for a period of 24 years. Faust agreed to give himself up to Satan at the end of that time. Mephistopheles entertained his master with high living, long discussions on the relation of the devil towards God, the nature of heaven and hell, the eternity of punishment for sin, and with glimpses of the spirit

world. At the end of the 24 years, in the midst of an earthquake which shook his house, Faust was carried off by the devil.

The story gained wide popularity and was used as a theme by many writers. It became the subject of a great dramatic poem, 'The Tragical History of Doctor Faustus' (1588?), by Christopher Marlowe, the father of English tragedy. Strolling players introduced the play into Germany where it degenerated into puppet-plays and Punch and Judy shows, until Goethe at the opening of the 19th century raised it to the level of powerful drama. (See Goethe.)

There gradually crept into the Faust legends the shadowy figure of a beautiful young German girl, Gretchen, a daughter of the common people, with whom Faust fell desperately in love. This element of the story grew in importance until in the hands of Goethe it blossomed into the charming personage of Margaret, whose betrayal by Faust is one of the dominant notes in Goethe's poetic tragedy 'Faust'. This is unquestionably the greatest treatment of the legend. Contrary to the early versions, Mephistopheles fails to absorb Faust completely in the pleasures he provides—one of the conditions of the compact in Goethe's poem—and the result is the ultimate salvation of the magician. Gounod's opera 'Faust', adapted from Goethe's tragedy, was first produced in Paris in 1859 (see Opera). Rembrandt was one of many artists who illustrated the legend.

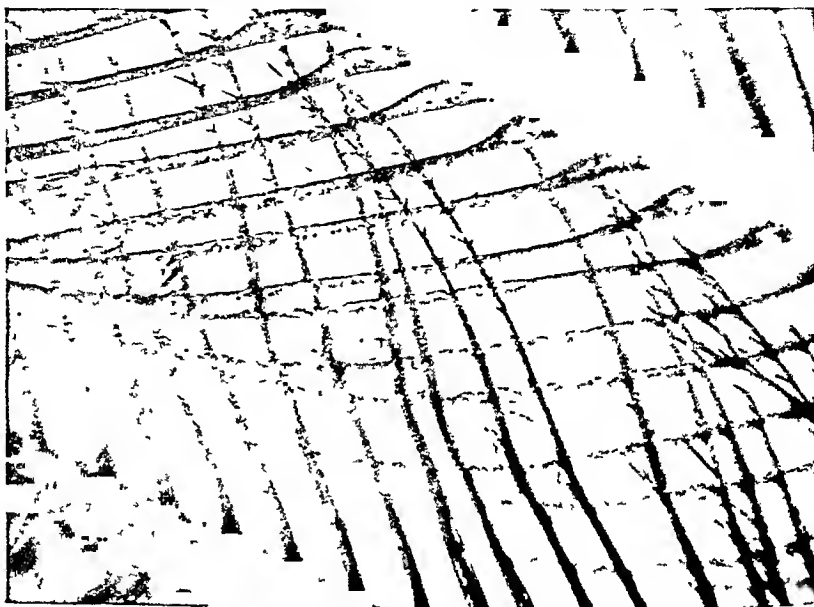
FAWKES, GUY (1570-1606). November 5 is Guy Fawkes Day in Britain, the anniversary of the Gunpowder Plot (1605) to blow up king and parliament. At night huge bonfires are lit to burn grotesque stuffed figures called *guys*. Fawkes was not the leader of the Gunpowder Plot, but his name is most commonly connected with it because, as a military man, he was to be in charge of the actual explosion.

James I had been dealing harshly with Catholics. A group of Catholics, headed by Robert Catesby, hatched the plot, hoping to seize power in the confusion that would follow. Thirty barrels of gunpowder were hidden in a cellar under Parliament House. One of the plotters could not resist warning a friend to stay away. This led to the discovery of the gunpowder on November 5. All the conspirators, including Guy Fawkes, were executed.

FEATHERS. The wing feather of a bird rests as lightly in your hand as a delicate leaf. It will float away on a puff of wind. Yet for strength and efficiency the finest airplane has no part that can compare with it. A wing feather is one of the most beautifully designed structures in the world.

If you will examine a feather you will see how wonderfully it is made. A tapering shaft runs through it like a leaf stem. Despite its airy lightness, this tough hornlike shaft can be bent like a bow or

THE SECRET OF A FEATHER'S MAGIC WEB



Two adjoining "branches" of a wing feather are here magnified about 120 times. The picture shows how the tiny barbed "hairs" along the branches interweave and interlock to help make the web of the feather a strong and effective "air catcher."

whipped back and forth like a baton without snapping. This shaft gives the feather strength.

The web of the feather flares out from the shaft. It is made up of tiny branches which lie close, side by side. Rub the outer edge of the web downward, and the branches tear apart easily. The feather looks ruined. But now smooth the ruffled web upward between your fingers. As if by magic, the branches mesh again and the feather looks like new. A microscope will show you why. From each branch, hooklets reach out and interlock with the hooklets of the branches next to it. When you rub downward, the hooklets disengage. But when you stroke the branches upward, they reknit like zippers. This is what happens when a bird preens its ruffled feathers.

Held together by the hooklets, the branches form a web so dense that little or no air leaks through it when the bird flaps its wings in flight. When hooklets are lacking, however, as in the plumes of the ostrich, the bird cannot fly at all. Blow hard against the web, and it will bend but not break. When gales buffet flying birds, the web proves to be strong and flexible. It bends to the wind, changing the

pitch of the wings so that birds ride air currents more gracefully than any man-made glider can ever do.

Feathers mean more than flight to a bird. They give protection too. Oiled by the skin and overlapped like shingles, they shed the most drenching rains. The air spaces between the feathers insulate the body and keep the birds comfortable whether they live at the Equator or at the Poles. Under the breast feathers, which have an undergrowth of down, birds incubate their eggs and nestle their young in a softness and warmth that only a bird can fully know. By stuffing pillows and padding beds with down, men have gained an inkling of this comfort.

Color and Growth of Feathers

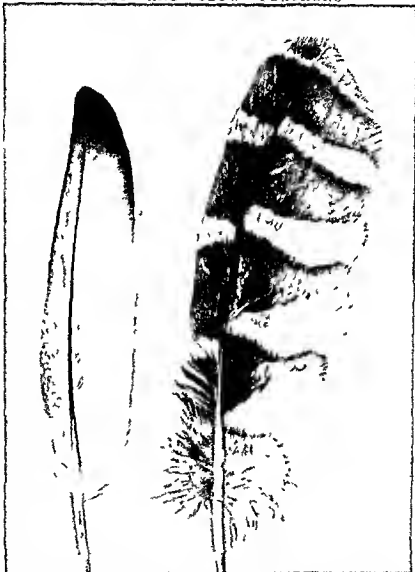
Few masterpieces of painting can compare with feathers in liveliest softness and harmony of colors. The black, brown and gray pigments come from the bird's blood; the brilliant yellow pigments from its fat. The rainbow colors shimmering on throat and tail feathers come not from pigments but from refracted light. Microscopic ridges on the feathers break up the light that falls on them into the colors of the spectrum. So beautiful are feathers in pattern as well as color that men since ancient times have taken them from birds to adorn themselves.

Like the hairs of mammals and the scales of reptiles, feathers are horny outgrowths of the skin. They spring from pits found in certain areas of the skin and overlap to cover the entire body. Each pit is supplied with blood to nourish the growing feather. How the young birds develop feathers and how all

birds shed them at regular intervals (*molt*), is told in the article on birds.

Special muscles in the skin control the feathers so that a bird can fluff them out to keep warm or to

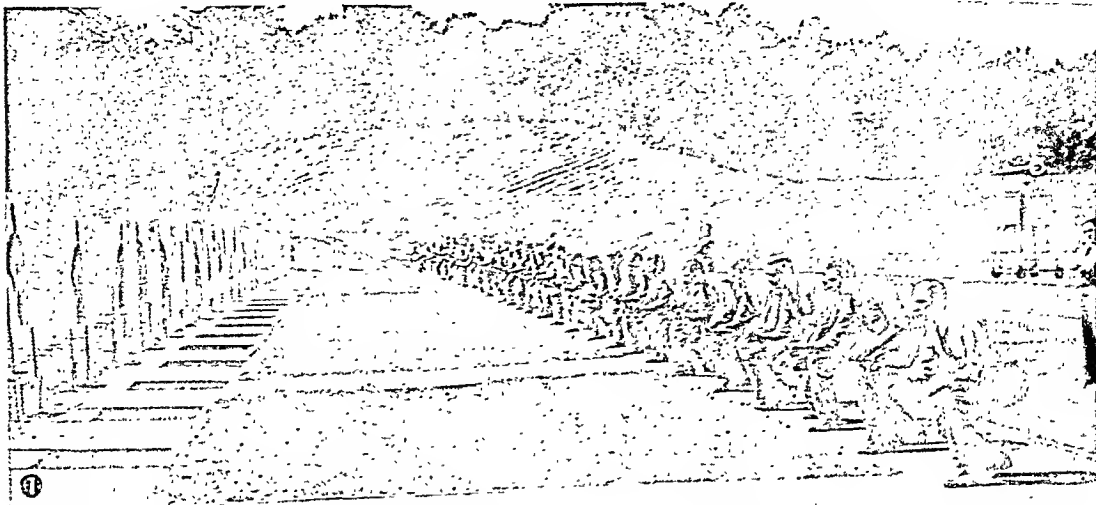
'FAST' AND 'SLOW' FEATHERS



Feathers built for speed are hard and trim like the pigeon feather on the left. The soft, loose edged feather on the right is from the owl. Because of its softness the owl's flight is slow and noiseless, which is more important to the owl than speed.

attract another bird at mating time. Often he fluffs out his feathers to frighten away enemies by making himself look larger than he really is. Many birds, particularly the peacock, spread their tail feathers into gorgeous fans to court females or merely to show off. When a bird floats lazily in the skies

WHY THE CRIMINAL WORLD FEARS THE FBI



or glides down to a landing on tree or earth, the tail feathers are spread out to catch the air currents and control the flight.

The Parts of a Feather

The shaft of a feather has two parts. The lower part, the *quill*, is hollow. The upper part, the *rachis*, is solid. It supports the web, or *vane*. In some feathers, as in the bristles about the mouth of a flycatcher, the vane may be nearly or quite absent; or it may become solidified into scales, as on the penguin. The feathers that form down have little or no shaft, and the barbs do not interlock to the same degree as in stiffer feathers.

Feathers are used on butts of arrows to make them fly straight (*see Archery*). Large feathers, their shafts sharpened to form "quill pens," were used for writing (*see Pen*).

FEBRUARY. In the old Roman calendar February (from *februare*, meaning "to purify"), the second month of the year, had 29 days. It was robbed of a day to make August, named in honor of Emperor Augustus, as long as July, which had been named for Augustus' predecessor Julius Caesar. In leap year February recovers its 29th day. (*See Calendar*.)

FEDERAL BUREAU OF INVESTIGATION. One of the most important divisions of the Department of Justice is the Federal Bureau of Investigation, or FBI. Criminals fear it as the most efficient crime detection



1. At the FBI school in Quantico, Va., agents practise shooting from the hip. 2. An FBI expert combs the fraudulent check files to identify a forger's handwriting. 3. A spectrograph test reveals the composition of a metallic particle.

bureau in the world. Its agents are popularly called "G-men," or "Government-men." FBI headquarters are in the Department of Justice building in Washington, D. C. The FBI laboratories use the latest scientific methods to solve crimes.

The FBI investigates violations of all federal laws, except such offenses as counterfeiting and violations of postal, customs, and internal revenue laws. These are assigned to other agencies. The FBI has jurisdiction over treason, sabotage, espionage, and other crimes that threaten the internal security of the United States. Among the approximately 120 federal statutes the FBI enforces are the National Bank Act, the Federal Kidnapping Statute, the National Motor Vehicle Theft Act, and the Atomic Energy Act of 1946.

Created in 1905, the bureau was reorganized in 1934. It was officially designated as the Federal Bureau of Investigation in 1935. It maintains field divisions in 50 cities of the United States and in San Juan, Puerto Rico, Honolulu, Hawaii, and Anchorage, Alaska. John Edgar Hoover was appointed director in 1924.

The FBI maintains detailed records, including fingerprint

files, and complete crime laboratories. These are at the service of all local state and national law-enforcement bodies in the United States. The laboratories are manned by trained scientists. They analyze and identify blood, firearms and bullets, poisons, hairs and fibers, soils and minerals and metals. Often the solution of a puzzling crime turns upon the identification of one of these materials.

One of the FBI's major divisions is the National Police Academy. Here selected men from municipal and state police forces attend school to learn scientific crime detection methods. These men become leaders in their own police training programs. The FBI also sends instructors to teach at local schools for smaller police forces.

A candidate for a position as FBI agent must be between 25 and 40 and hold a degree in law or accounting. He must be at least 5 feet 7 inches tall and have good eyesight. He must also be a citizen of the United States. He is trained in all phases of the work from accurate shooting to collecting evidence that will hold in court.

FEDERAL DEPOSIT INSURANCE CORPORATION
In the depression of the 1930's the banking system of the United States suffered seriously. Hundreds of banks failed. Depositors lost millions of dollars. To meet the crisis President F. D. Roosevelt declared a banking holiday on March 5, 1933, and closed all banks. Congress passed emergency banking laws.

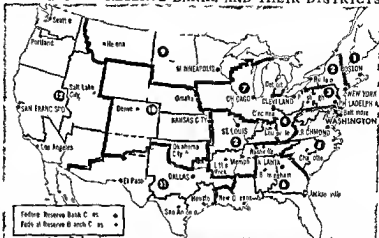
On June 16 it enacted the Banking Act of 1933. Among its banking reforms it created the Federal Deposit Insurance Corporation. Congress made the FDIC permanent in the Banking Act of 1935. The chief purpose of the FDIC is to insure deposits. Originally the maximum insurable deposit was \$5,000 but in 1950 this was raised to \$10,000. When an insured bank closes the FDIC acts as receiver and pays depositors. The FDIC bans unsound banking practices. Since 1942 it has supervised federal credit unions.

The government does not guarantee deposits but administers an insurance fund financed by the banks themselves. Of the original capital of \$290,000,000 the United States treasury provided \$150,000,000 and the 12 Federal Reserve banks contributed \$140,000,000. By 1951 total capital was more than \$1,200,000,000. Congress appropriates no money for the corporation. Each insured bank pays an insurance fee of one-twelfth of one per cent a year on its deposits.

Almost all the banks and the insurable deposits in the United States are protected by the FDIC. All banks of the Federal Reserve System national and

state must have their deposits insured by the corporation. Nonmember state banks may be insured upon approval by the Corporation. A board of directors of three members manages the Corporation. The president appoints two members for six-year terms with the approval of the Senate. The comptroller of the currency is the third member. One of the appointed members is made chairman of the board.

THE FEDERAL RESERVE BANKS AND THEIR DISTRICTS



The map shows the 12 Federal Reserve bank cities and their districts, outlined in heavy lines. Note that the district lines cut through state boundaries to serve business regions related to the cities. The map also shows the 24 Federal Reserve branch cities and their territories.

FEDERAL RESERVE SYSTEM Before 1913 American business suffered for lack of an elastic currency which could be increased or decreased in total amount in circulation according to business needs.

In good times the banks could not get currency enough to protect the credit money they created by granting loans (see Banks). In bad times when help was needed most the banks had to call loans to pile up cash reserves. These problems led Congress to pass the Federal Reserve Act proposed by Senator Carter Glass of Virginia and approved by President Woodrow Wilson Dec. 23, 1913. It has often been amended.

Most nations have one central bank but the United States system rests on 12 district Federal Reserve banks with 24 branches. All national banks must subscribe to the stock of the Reserve bank in their district. State banks and trust companies may join. The Reserve banks are supervised by a Board of Governors which under the Banking Act of 1935 replaced the Federal Reserve Board. The president of the United States with the Senate's consent appoints its seven members for 14-year terms and names one as chairman. The board of directors of each Reserve bank has nine members. Six of these—three bankers and three nonbankers—are elected by member banks. The rest are named by the Board of Governors.

The Federal Reserve uses three chief methods to regulate the amount of currency and bank credit. They are discounts, open market operations and interest

requirements. A member bank must keep a reserve with a Reserve bank. The reserve is a certain amount of the funds deposited with a member bank. A member bank may obtain additional reserve by *rediscounting*, at a Reserve bank, notes given by its borrowers or by getting loans or advances on other kinds of eligible securities. The Reserve bank then issues *Federal Reserve notes* to the bank or credits its account. Either method increases the member bank's ability to meet its customers' needs. The Reserve bank charges interest at a *discount rate*. Raising or lowering this rate influences the national supply of money.

Federal Reserve notes are the bulk of paper money. The Reserve banks must hold a 25 per cent reserve in gold certificates against their notes and their deposits. *Federal Reserve bank notes* may be issued by the Reserve banks secured by government bonds.

The Federal Reserve may also regulate credit by buying and selling securities, chiefly government bonds, in *open-market operations*. When the System buys securities, dealers deposit Federal Reserve checks with member banks, which in turn deposit them with Reserve banks. Thus the Reserve banks add to the reserves of the member banks and permit expansion of credit. When the System sells securities, dealers draw checks on member banks, and this reduces the reserves of the member banks. Thus contraction of credit is encouraged. The Federal Open Market Committee, consisting of the Board of Governors and five representatives elected by the Reserve banks, supervises open-market operations.

The Federal Reserve may affect the money supply by changing the reserves that member banks must keep with Reserve banks. It may fix *reserve requirements* for demand deposits between 13 and 26 per cent for central reserve city banks; 10 and 20 per cent for reserve city banks; and 7 and 14 per cent for country banks. Reserves for time deposits of all member banks are fixed between 3 and 6 percent.

FEDERAL TRADE COMMISSION. President Wilson's administration felt that many "big business" abuses were difficult to correct under the antitrust laws. Congress therefore passed an act approved Sept. 26, 1914, which stated that "unfair methods of competition are hereby declared unlawful," and created a Federal Trade Commission to enforce this declaration. Decision as to "fairness" was left to the Commission; but it had to apply to the United States Circuit Court of Appeals for enforcement of its orders.

The FTC has five members appointed by the president for seven-year terms. It reports on business conditions and conducts investigations and hearings on complaints from individuals and companies. If the defendants contest the findings of the Commission's examiners, the Commission holds a hearing amounting to a trial. The Commission then may issue an order to the defendant to "cease and desist" from the unfair practise. Defendants who plead guilty, however, are often permitted to make a *stipulation*, or admission of facts. In this, the defendant promises to stop his unfair acts. He thus avoids the expense of a hearing.

Congress has extended the jurisdiction of the Commission. It not only aids small business by suppressing monopolistic and corrupt practises, but also protects consumers. The Commission administers sections of the Clayton Anti-Trust Act of 1914 and the Webb-Pomereene Act of 1918, which governs export-trade associations. The Robinson-Patman Act of 1936 enlarged its powers over price discrimination.

Amendments in 1938 empower the Commission to forbid false advertising of food, drugs, or cosmetics. Also under the amendments, its orders become final without court review unless appealed. The Commission regulates labeling of wool merchandise under the Wool Products Labeling Act of 1939 and trade-marks under the Lanham Trade-Mark Act of 1946. Since 1946, the FTC has greatly encouraged industry-wide voluntary elimination of unfair trade. (See also Monopolies.)

FELDSPAR. The minerals feldspar and quartz are parents of most rocks. Feldspar forms about half the earth's crust. Granite and related rocks contain it, and it occurs in nearly pure masses called *pegmatite dikes*.

When pulverized and fused, feldspar becomes a tough glasslike substance. American industry uses about 400,000 tons a year, chiefly in making a type of glass which is especially durable because of the aluminum content of feldspar. It is also used as a glaze for pottery, sanitary ware, and tile; as a binder in pottery and in emery wheels; and as an abrasive in scouring soaps.

The United States supplies from one half to three fifths of the world's annual output. The chief producing states are North Carolina, South Dakota, Colorado, and Virginia. Foreign producers include Sweden, Norway, Germany, France, and Canada. Feldspar is aluminum silicate combined with silicate of potassium, sodium, or calcium. (See also Minerals.)

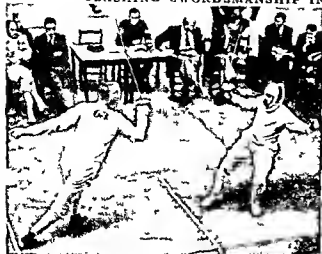
FELT. A fabric made by pressing loose fibers together is called felt. A carding machine combs masses of fibers into webs. Several of these are steamed together under pressure and then pounded into a flat fabric. Wool, fur, and some hairs make the best felt. These animal fibers are covered with tiny scales that interlock and hold the fibers together. With cotton or synthetic fibers, fur or wool is used as a binder.

Felt is used for such varied articles as hats, house shoes, billiard table covers, piano hammer pads, and in Mongolia for the walls and roofs of houses. (See also Fabrics; Mongolia.)

FENCING. Perhaps more than any other sport, fencing demands a keen eye, quick reflexes, and agility. Like boxing, it also demands an aggressive and competitive spirit. The sport originated as a training method for swordsmanship and dueling (see Sword). But today fencing is conducted as a harmless sport, and every precaution is taken to prevent accidental injury. The weapons have dulled edges and blunted tips capped with buttons. The fencers wear protective padded jackets, gloves, and wire masks. Points are scored by merely touching the opponent.

The word "fencing" comes from the same Latin root, *fendere*, as the words "offense" and "defense." On offense, the fencer attacks by *lunging*. On defense,

SLASHING SWORDSMANSHIP IN SABER MATCHES



Left an Olympic saber bout is filled with action. The fencer at left has taken the offensive and is driving his opponent back on the strip. Soon he will maneuver him into position to score. Right a fencer scores a touch (*touche*) by the *coup droit* : attack. Note the span of his left in the lunge. His opponent stands in the parry position ready to counterattack if the *coup droit* had missed its mark. All fencers wear the protective clothing shown here. Breeches or long trousers are optional.

he turns away his opponent's blade with a parry and then may counterattack with a continuing movement called a *riposte*. These methods are common to all three types of fencing: foil, *épée* and *saber* so named from the different weapons used. The matches take place on a strip 40 feet long and about 6 feet wide.

Delicate and Precise Foil Fencing

Foil fencing is the most popular of the three and beginners usually learn to use the foil first. The weapon itself is of lighter steel. It is about 43 inches long and weighs about 17 ounces. Above the small guard or hilt is a curved grip usually wrapped with twine. For safety the tip of the blade is covered with a button. Points are scored by touching the opponent with the button in an area from the collar to the groin in front and to the hipbone line in back.

There are three simple attacks, each starting with the weapons crossed in the engaged position. The *coup droit* is a straight lunge with extended arm. In *défilé* the attacker passes his point under the other's blade and then lunges. In *coupé* the attacker passes his point over the other's point before lunging. Each of these is designed to score a touch or *touche* before the opponent can parry. If the parry is successful the opponent follows through with his *riposte*.

Attacks can come from eight different points and there is a possible parry for each point. The parries are often called by old French words for first through eighth: *prime seconde tierce quarte quinte sixte septime and octave*. Of these the most important are quarte and sixte. In quarte the foil hand is held to the left, gripping the weapon with the thumb on top and the fingertips pointing up. This parry protects the high left side of the vulnerable area.

In sixte the hand is held straight out with the fingertips on top to protect the high right side.

It is extremely important that only one fencer lunge at a time. His blade must be parried before the other starts his lunge. This is called the right-of-way rule and is designed to prevent accidents. If the opponents lunged and scored touches together the referee might arch to the snapping point.

Épée and Saber

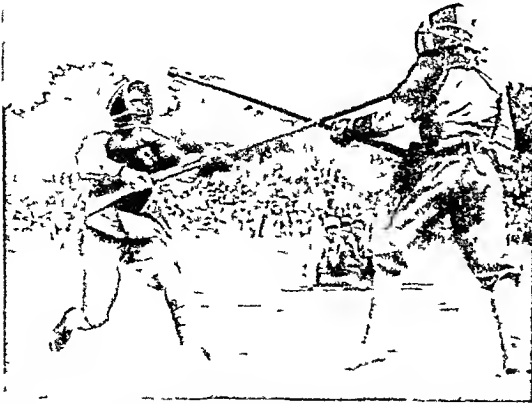
The *épée* is heavier and more rigid than the foil although about the same length. Every part of the body is vulnerable in *épée* fencing. As in foil points are scored by touching the button. *Épée* is somewhat slower than foil since the blade is less maneuverable and most of the hits are scored on the forearm. *Épée* does not use the right-of-way rule and the first to touch receives the score.

LUNGE AND PARRY



The fencer at right has traded her opponent's lunge by shifting position and by executing a *prime* parry. With her hand held high she deflects her opponent's blade as shown.

"FENCING" WITH STICKS



Many types of stick fighting grew, as fencing did, from training methods for swordsmanship. Later they were adapted for bayonet training. Here two Japanese battle with long staves, simulating either a samurai sword or bayonet contest.

Saber fencing is a far more vigorous, slashing sport, since points can be scored with the button, the front (or "cutting") edge of the blade, or the last third of the back of the blade. The saber weighs about the same as a foil but is about two inches shorter. The guard extends in a curved piece to the base of the

grip. The vulnerable area is the body from the waist up, including the head and arms. The basic attacks and parries are the same as in foil, except that there is less delicate "conversation," as fencers call the interplay of foils, and more muscular lunges and ripostes. As in foil, the right-of-way is enforced, and the opponent must parry before attacking.

FERMENTATION. When milk sours or bread rises, when fruit decays, when you digest food, when alcohol is produced in sugary substances, and when that alcohol turns again to vinegar, you have in every case an example of the process called fermentation.

Fermentation is always due directly or indirectly to living organisms and consists of the breaking up of some substance into simpler forms. Common yeast, for instance, which is a mass of tiny plants akin to the bacteria, breaks up sugar into alcohol and carbon dioxide. This change is not caused directly by the yeast but by substances called "enzymes" produced in the living body of the yeast. Similarly our own bodies produce the enzymes which help digest our food. In the case of sour milk, butter, and cheese, the enzymes from certain types of bacteria produce the lactic and butyric acids that change the quality of the milk. Decay or putrefaction is similarly caused by a type of bacteria called *saprophytes*. (See Alcohol; Bacteria; Enzymes; Yeast).

PLANT SURVIVORS *from the* COAL AGE



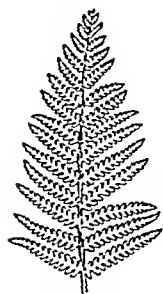
Fern fronds, or leaves, begin as little, fuzzy, curled-up balls called fiddleheads or croisers (left). They unfold and enlarge into the familiar leaf. At right are magnified clusters of spore cases (sori) on the underside of a leaf.

FERNS. In damp places in woods, ravines, and rocky crevices grow the feathery green ferns. They may be recognized by the shape of the leaves, known as fronds. These have a single midrib, with small leaflets branching off from either side. The leaflets may be delicately cut into toothed or lobed edges. Most of the familiar ferns grow from a creeping underground stem called a rootstock. Early in spring when they first appear above ground the fronds are tightly curled like a watch spring. As they straighten and

begin to uncurl they look like the neck of a violin; hence their popular name of *fiddlehead*. Another name for the young fern is *croiser*, from its resemblance to a bishop's crozier, or staff.

Ferns and their near relatives the horsetails and club mosses are nonflowering green plants. They grow from spores instead of from seeds. They belong to a very ancient group of plants that flourished ages before flowering plants appeared on the earth. In the period called the Carboniferous, or Coal, Age

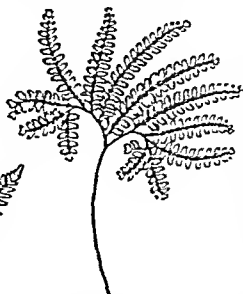
SIX OF THE BEST-KNOWN FERNS



CINNAMON



BRACKEN



MAIDENHAIR



CHRISTMAS



COMMON POLYPODY



INTERRUPTED

The cinnamon fern bears a tuft of cinnamon-colored fuzz at the base of each pinna. Bracken, also called brake, is large and coarse, with several leaflets branch-

ing in pairs from a tall stipe. The delicate maidenhair fronds branch fanwise. Each pinna of the Christmas fern looks like a tiny Christmas stocking. Common poly-

pody is a small fern with thick, deeply cut, smooth-edged fronds. The interrupted fern is interrupted part way along the midrib by small spore-bearing pinnae.

The familiar fern plant bearing spores is the *sporophyte*. To summarize: ferns produce spores; spores produce prothalli; in the prothalli grow eggs and sperms; sperms fertilize eggs; fertilized eggs grow into large fern plants.

Horsetails, Club Mosses, and Quillworts

The ferns have some interesting relatives which also reproduce by means of spores. The common field horsetail is abundant in moist meadows and along railroad embankments, hard, dry roadsides, and stream banks. It produces two very different looking stems. The fertile stem appears early in the spring. It is pale colored because it contains no chlorophyll. The stem is cylindrical and jointed at intervals. Around the joints are black-tipped, upward-pointing scales, which are reduced leaves. At the top of the stem is a cone-like structure which contains the spores.

After the ripened spores have scattered, this stem dies down. Another grows up from the underground rootstock. This is the sterile vegetative stem. At

the joints grows a circle of branches which are also jointed, or segmented. These branches are green. Their chlorophyll makes food for the entire plant. Surplus food is stored in the rootstock in the fall, and the following spring the colorless fertile plant draws on it to develop its spores. The queer, brushy sterile stalks are supposed to look like horses' tails. Horsetails contain silica, a sandlike material. Pioneer housewives used them to scour kettles—hence another popular name for the plant, "scouring rushes."

Club mosses, or ground pines, are small, ground-clinging plants that grow in dry, coniferous woods. They have tiny club-shaped cones at the ends of trailing branches. The scalelike leaves resemble those of moss. Quillworts grow in shallow waters and along their shores. They have slender grasslike leaves.

Ferns and their allies belong to the division *Pteridophyta*. It is divided into the following orders: ferns, *Eufilicales*; horsetails, *Equisetales*; club mosses, *Lycopodiales*; quillworts, *Isoetales*.

CLUB MOSS AND FIELD HORSETAIL



This little evergreen plant, called club moss, is much used for Christmas decorations and as a result has disappeared from many regions where it was once abundant. The clusters of cones are the spore cases. The flat, scalelike leaves resemble moss.



The field horsetail is a common plant in waste places everywhere. Its wandlike, jointed stems resemble bamboo. The plants with cones at the top bear the spores. Those with the scaly leaves in whorls around the stem are sterile plants.

FERTILIZERS Wild plants take certain chemicals from the soil as food. When they die they soon decay and return the chemicals to the soil. But what happens when men harvest crops? The harvested plants take with them most of the food they took from the soil. If this goes on year after year and no replacements are made the soil becomes impoverished.

To avoid this farmers and gardeners supply plant food in the form of fertilizers. The wise farmer is careful to save stable manure, well rotted straw and leaves (called compost), wood ashes and other waste materials for they contain at least a part of the plant food taken from the soil. These are called *natural fertilizers*.

Plants Should Be Strictly Dieted

The growing plant requires ten essential elements of plant food. Those that are used up in largest quantity must be put back into the soil in largest quantity. These are principally nitrogen, phosphorus and potash. Commercial fertilizers therefore contain these three foods. Lime is also frequently required to overcome soil acidity for many plants do not flourish in an acid soil. (See also Soil Plant Life.)

The farmer should understand the food requirements of his crops. Nitrogen produces a large vigorous plant while phosphorus and potash give strength to the plant and enable it to bear abundant fruit.

Nitrogen can be obtained from many substances. One of the commonest is ammonium sulfate, a by-product of coke manufacture. Another is sodium nitrate. Years ago this could be obtained only from the great natural nitrate deposits in Chile. Today it is made in large quantities from the nitrogen in the air. Other common sources of fertilizer nitrogen are cotton seed meal, the residue left after the oil is extracted from cottonseed, and animal products such as dried

blood tankage (by products of the meat-packing industry) and fish meal prepared from nonedible fish and waste from fish canneries. Low-cost synthetic nitrogen from ammonium nitrates, ammonia and ammonia solutions is now the principal supply of nitrogen fertilizer in the United States. Ammonia is applied to farm fields in liquid form. (See Nitrogen.)

Phosphate and Potash Fertilizers

Phosphorus in the form of calcium phosphate is obtained from natural deposits of phosphate rock found principally in Florida, Tennessee, Montana and Idaho. To render the phosphate more digestible for the plant, the rock is ground and treated with sulfuric acid to form superphosphate. This is the principal constituent of most commercial fertilizers.

Before 1914 Germany and France produced most of the world's potash. Since then however extensive deposits have been discovered and developed in the United States. Large quantities of high grade potash are now produced from Searles Lake in California and from mines in New Mexico (see Potassium).

The manufacturer grinds these raw materials to powder, mixes them in the right proportions and packs them in bags. On each bag he places a tag or label showing exactly how much nitrogen (N), phosphorus (P_2O_5) and potash (K_2O) the mixture contains.

Since the second World War American farmers have used about 17 million tons of commercial fertilizers in an average year. The quantity used rises and falls with farm income. The farmer expects to obtain on one acre fertilized as large a crop as he would obtain from two or three acres unfertilized. This means he has less work to do per unit of crop raised. So fertilizers increase profits, save labor and most important of all preserve the fertility of the soil.

DAYS of CELEBRATION *the World AROUND*

FESTIVALS AND HOLIDAYS Holidays have been observed in all ages and among practically all peoples. The ancient Greeks had Olympic games and many other festivals. The Romans celebrated Lupercalia in the spring and Saturnalia in midwinter with games, fantastic amusements and giving of presents. The earliest of all festivals seem to have been connected with offerings to the dead. Later the seasons were recognized by festivals. Seed time and harvest were occasions for special rejoicing.

All early festivals were in some measure religious. Thus the word holiday meant originally holy day. Holidays celebrating historical events came later.

The United States has no national holidays. The president proclaims and Congress declares legal holidays, but these apply only to the District of Columbia, territories and federal employees. The states by legislation or proclamation make holidays legal. Nearly all states have designated the following as legal holidays: New Year's Day (January 1), Washington's Birthday (February 22), Memorial Day (May 30 in the North, April 26 or May 10 in most South-

ern states), Independence Day (July 4), Labor Day (first Monday in September), Veterans Day (November 11), Thanksgiving Day (usually the fourth Thursday in November) and Christmas (December 25).

Holidays which have no legal status include Valentine's Day (February 14), April Fools' Day (April 1), May Day (May 1) and Halloween (October 31).

Independence Day, the Fourth of July, is the greatest patriotic holiday in the United States. The Fourth and several days before it have long been

marked by explosions of torpedoes, firecrackers and other noisemakers as well as displays of fireworks (see Fireworks). For many years these explosives took a heavy toll of life but the same Fourth idea greatly lessened the casualties. Many cities forbid the indiscriminate sale of firecrackers and communities have fireworks displays conducted by experts.

Anniversaries celebrated by special community and school programs in many states are Lincoln's Birthday (February 12), Arbor Day (date varies by state), Mother's Day (second Sunday in May), Flag Day (June 14) and Columbus Day (October 12).

In Canada legal holidays are Dominion Day, also called Canada or Confederation Day (July 1), New Year's Day, Good Friday, Easter Monday, Christmas Day, Victoria or Empire Day (May 24), Labor Day, and the birthday of the reigning sovereign.

Occasions Often Observed in the United States

MANY states, territories, and possessions of the United States celebrate events of special local significance and the birthdays of notable persons who were born within their borders or lived there for some time. Many of the celebrations are observed principally in the schools. Most libraries contain literature on methods for observing such special days.

The following list contains most of the holidays observed in the United States. The words in *italics* indicate states or cities where the observance is of greatest interest. (For a list of birthdays by months, see Birthdays in the FACT-INDEX.)

January

1. New Year's Day.
8. Battle of New Orleans (1815). Andrew Jackson and his frontiersmen defeated British forces engaged in War of 1812. *Louisiana*.
11. Alexander Hamilton's Birthday (1757). *New York*.
17. Benjamin Franklin's Birthday. In recognition of Franklin's advocacy of thrift, a week beginning with his birthday may be observed as Thrift Week.
18. Daniel Webster's Birthday (1782). *Massachusetts*.

CHRISTMAS IN THE UNITED STATES



Weeks of anticipation come to a climax when children open their presents around the Christmas Tree.

19. Robert E. Lee's Birthday; also Lee-Jackson Day (1807). *Southern states*.

30. Franklin D. Roosevelt's Birthday. This is the occasion of an annual campaign to collect money for the benefit of infantile paralysis sufferers.

February

2. Candlemas. A Christian festival observed since the 11th century by the blessing of candles for church use. This date is also popularly known as Groundhog Day (*see Groundhog*).
8. Boy Scout Day. Boy Scouts of America chartered 1910.
11. Thomas A. Edison's Birthday (1847). *Most states*.
12. Lincoln's Birthday (1809).
12. Oglethorpe Day (1733). Gen. James Edward Oglethorpe established Colony of Georgia at Savannah. *Georgia*.
14. Saint Valentine's Day (*see Saint Valentine's Day*).
15. Battleship Day. The blowing up of the *Maine* in the harbor of Havana, with the loss of 260 lives, was one of the events that led to the Spanish-American War. *Maine*.
22. Washington's Birthday (1732).
24. Capture of Vincennes (1779). George Rogers Clark and his Virginia Riflemen defeated the British here. *Indiana*.

March

2. Independence Day (Sam Houston Memorial Day) (1836). Texas declared its independence from Mexico. Houston was its great general and first president. *Texas*.
6. Siege of the Alamo (1836). Fortified Franciscan mission, The Alamo, which was defended to the last man by its garrison of Texans, captured by Mexicans. *Texas*.
7. Luther Burbank's Birthday (1849). *California*.
17. Evacuation Day (1776). British forces, imperiled by Washington, left Boston. *Boston, Mass.*
25. Maryland Day (1634). Roman Catholic mass celebrated for first time in Maryland colony. *Maryland*.
30. Alaska Purchase (1867). *Alaska*.

April

1. April Fools' Day. The custom of playing pranks on this day is so old that its origin is uncertain. (*See April*).
6. Army Day (before 1950). Celebrated before the unification of the armed forces; now merged in Armed Forces Day, third Saturday in May.
9. Appomattox Day (1865). Lee surrendered to Grant.
14. Pan American Day. On this day, in 1890, a resolution was adopted resulting in the Pan American Union. Commemorates the friendship of the 21 American republics.
18. Paul Revere's Ride (1775). *Massachusetts*.
19. Patriot's Day (1775). Anniversary of battle of Lexington and Concord. *Massachusetts; Maine*.
21. Battle of San Jacinto (1836). Mexicans defeated by General Houston. *Texas*.

May

1. May Day. This ancient festival is celebrated by Maypole dances and other gala activities (*see May*).
1. Child Health Day. First set aside by President Hoover in 1930 to encourage child welfare work.
8. V-E Day. Surrender of Nazi Germany in 1945 brought victory in Europe (V-E) in the second World War.
13. Settlement of Jamestown (1607). *Virginia*.
18. Peace Day, or World Good-will Day. On this day in 1899, the first international conference for world peace met at The Hague (*see Hague Peace Conferences*).
22. Maritime Day. On May 22, 1819, the steamship *Saranah* began the first successful transatlantic voyage by steam.
30. Memorial Day or Decoration Day. This day marks tributes, by special exercises and the decorating of graves, to soldiers and sailors in all the wars of the United States. Southern states observe it on April 26, May 10, or June 3. The idea of a memorial day originated in Columbus, Miss., where formal exercises were held at Friendship Cemetery in 1866. The custom was soon followed in other places. General John A. Logan, commander in chief of the Grand Army of the Republic, designated May 30, 1868, for decorating the graves of dead Union soldiers. Congress has never made Memorial Day a national holiday, but it is a legal holiday in all northern states. May 30 may have been chosen

because that was the date of the discharge of the last Union volunteers (See Memorial Day)

June

11 Kamehameha Day (1760?) Birthday of first king Hawaii

14 Flag Day The flag is displayed in homes and public places to mark adoption of Stars and Stripes by Continental Congress in 1777 Flag-raising ceremonies instruction in flag etiquette and history parades and pageants feature some observances A legal holiday in some states in 1949 designated national Flag Day by Congress

15 Pioneers Day Idaho

17 Bunker Hill Day (1775) Massachusetts

23 Penn Treaty with Indians (1683) Pennsylvania

July

4 Independence Day The Declaration of Independence from Great Britain was passed by the Continental Congress at Philadelphia Pennsylvania in 1776 was the first state to make this occasion a legal holiday However there is a record of its observance by the citizens of New Bern N C in 1778 and it was celebrated elsewhere before the action of Pennsylvania was followed by all the states

4 Providence founded (1636) Rhode Island

24 Pioneers Day Utah

August

16 Battle of Bennington (1777) Green Mountain Boys defeated British Vermont

19 National Aviation Day Observed with appropriate exercises to stimulate interest in aviation

September

2 V-J Day Surrender of Japan brought victory over Japan (V-J) in 1945 and ended the second World War

12 Defenders Day (1814) Defense of Baltimore in War of 1812 Maryland

17 Citizenship Day Congress in 1952 established this day for public recognition of all who by coming of age or by naturalization have become citizens in the past year

17 Constitution Day (1787) The Constitutional Convention adopted the United States Constitution on this day

22 Emancipation Day (1862) Lincoln read Emancipation Proclamation

29 Leaf Ericson Day (1800) Norsemen under Ericson's leadership reached the American continent

October

9 Fire Prevention Day This is the anniversary of the beginning of the fire that wiped out most of Chicago in 1871

MEXICAN CHILDREN ON CORPUS CHRISTI DAY



On Corpus Christi Day Mexican children attend church dressed in native costumes. On the little boy a back is a tiny cradle like those used by Indian porters to carry goods to market. Fastened to wire baskets and a tiny bed mat of straw called a petate. The girls carry flowers. Straw burros are sold everywhere. They are usually filled with flowers and sweets but the one at the left holds a baby's bottle.

A CARNIVAL BEFORE LENT



Shrove Tuesday ushering in the Lenten season, is the occasion of a colorful feast in the old Belgian town of Bruges where clowns or guinea parade the cobbled streets with bells and feather plumes tossing oranges to the crowds along the way.

12 Columbus Day (1492) Celebrates the landing of Columbus at San Salvador observed not only in the Americas but also in Spain and Italy

17 Burgoyne's surrender (1777) New York

19 Cornwallis surrender (1781) Virginia

24 United Nations Day Commemorates ratification of charter Some nations set aside seven days October 17-24

27 Navy Day (before 1950) and Roosevelt Day This is the birthday of Theodore Roosevelt who did much to strengthen the United States Navy Before 1950 the Navy was honored on this day now all branches of the military service are honored the third Saturday in May

30 John Adams Birthday (1735) Massachusetts

31 Halloween This festival with its merry punks has been observed for over 2,000 years (See Halloween)

November

11 Veterans Day (1954) This legal holiday was formerly called Armistice Day commemorating the cease-fire in World War I At 5:00 A.M. on Nov. 11, 1918 German representatives signed at Compiègne in France the armistice which ended the firing at 11:00 A.M. that day (See also Armistice) In 1954 on June 1 Congress changed the name to Veterans Day a day dedicated to world peace

December

21 Forefathers Day (1620) Mayflower reached Plymouth New England states

25 Christmas Day (see Christmas)

30 Rizal Day (1896) José Rizal Filipino patriot executed Philippines

Special Occasions on Varying Dates

Child Labor Day Last Sunday in January On this day educational programs relating to child employment are given by churches clubs schools and other organizations

Shrove Tuesday (Mardi Gras) On this day which is the last before the beginning of Lent the Mardi Gras festival at New Orleans comes to a gala close Alabama Florida Louisiana

Mother's Day. Second Sunday in May. Mothers are honored on this day by special exercises and by messages, gifts, and visits from their children. It has been generally observed since 1914, when President Woodrow Wilson issued a proclamation calling for its celebration and the displaying of the United States flag on all public buildings. The idea was the inspiration of Miss Anna M. Jarvis, of Philadelphia, who in May 1907 suggested that a special service

Armed Forces Day. Third Saturday in May. Established in 1949 to honor all the armed services on one day.

I Am an American Day. The third Sunday in May was set aside in 1940 for the recognition of new citizens. Replaced in 1952 by Citizenship Day, September 17.

Children's Day. Second Sunday in June. Many churches observe this occasion by special sermons, and programs of pageants and plays in which children often have a part.

It dates back to 1856, when the Universalist Church of the Redeemer in Chelsea, Mass., held a special children's service.

Father's Day. Third Sunday in June. First celebrated in Spokane, Wash., in 1910, at the suggestion of Mrs. John B. Dodd, this day is observed in most states.

Labor Day. First Monday in September. This holiday began with a labor parade in New York City, Sept. 5, 1882. It has been adopted by all the states and territories and by Canada. In many foreign countries labor groups celebrate May 1 as a holiday and a day for demonstrations.

Indian Day. Fourth Friday in September. Illinois and some other states have set aside this day for special exercises in the schools relating to the history of the Indian in North America.

Gold Star Mother's Day. Last Sunday in September. Honors mothers who lost sons or daughters in either World War.

Education Week. About November 18-24. To emphasize the importance of public schools, many organizations, such as parent-teacher associations and community clubs, observe each day of one week by special programs on education. This practise of setting aside a week was started by Dr. P. P. Claxton in 1920, during his term as commissioner of education.

Thanksgiving. Usually the fourth Thursday in November. This is the American harvest festival. For its history, see Thanksgiving.

Arbor Day. By proclamation or legislation on various dates. This is an occasion for planting trees and emphasizing their beauty and utility. For its history, see Arbor Day.

THE FIRST THANKSGIVING



With Chief Massasoit and his tribesmen as guests, the Pilgrim Fathers celebrated their first harvest festival in October 1621. They had grown the vegetables in their own gardens. For meat they had wild fowl from the forests.

for mothers be held in a Philadelphia church. The next year other churches held similar services, and from that time the idea spread. Mother's Day is also celebrated in many foreign countries. A white carnation may be worn in memory of a mother who has died and a colored carnation to honor a mother who is living.

Foreign Holidays and Celebrations

GREAT events and birth dates of notable people are celebrated in various nations. Racial groups away from their homeland often observe these days by special programs.

January (between January 20 and February 19). Feast of lanterns (China). This feast concludes the two weeks' celebration that ushers in the Chinese New Year. It is made picturesque and noisy by lanterns and firecrackers.

March 1. St. David's Day (Wales). In honor of their patron saint, the Welsh wear the leek on this day.

March 3. Doll Festival (Japan). During this attractive three-day national festival for girls, elaborate sets of dolls are displayed in the homes (see Japan).

March 17. St. Patrick's Day (Ireland). The observance of the death of Ireland's patron saint is marked by the wearing of the shamrock (see Patrick, Saint).

April 23. St. George's Day (England). The martyrdom of England's patron saint was at first observed by the wearing of a red rose (see George, Saint).

May 1. Inaugurated by the Second International, 1889, as international labor day. A legal holiday in Russia.

May 5. Boys' Festival in Japan. Every house, where there is a son, flies a paper carp (see Japan).

May 17. Independence Day (Norway). On this day in 1814 the Norwegians adopted their first constitution.

May 24. Victoria Day or Empire Day (British Dominions). The anniversary of Queen Victoria's birth in 1819.

June (fifth day of the fifth moon). Dragon Boat Festival (China). During this festival, boatmen race along the many rivers of China in mock search for the body of Ku-Yuan, a statesman, who was drowned about 2,400 years ago. The day also marks efforts to placate the deity of the streams, the Dragon, so that the rivers will not overflow. Each boat carries on its prow an image of the god. Associated with this festival also are ceremonies to prevent the ravages of the "five insects," as they are called, the toad, viper, spider, centipede, and scorpion (for picture, see China).

June 5 Constitution Day (Denmark) On this date in 1949 Denmark became a constitutional monarchy

June 24 Bannockburn Day (Scotland) On this date in 1314 Robert Bruce drove the English out of Scotland and gained independence for the country (see Bruce Robert)

July 1 Dominion Day (Canada) also called Canada Day or Confederation Day Provinces of Canada, Nova Scotia and New Brunswick united as Dominion of Canada 1867

July 4 Garibaldi Day (Italy) The knight errant of Italian unity was born on this date in 1807

July 5 Independence Day (Venezuela) Under the leadership of Francisco Miranda as dictator Venezuela declared itself free from Spanish rule on this date in 1811

July 6 John Huss Day (Bohemia) John Huss met a martyr's death on this day in 1415 (see Huss John)

July 9 Independence Day (Argentina) A revolutionary congress in 1816 declared Argentina's independence

July 14 Bastille Day (France) The storming of the Bastille in 1789 was the turning point of the French Revolution

July 21 Independence Day (Belgium) On this day in 1831 Leopold entered Brussels as king of Belgium following the separation of that country from Holland

July 28 Independence Day (Peru) Peru became independent of Spanish rule in 1821

July 29 St Olaf's Day (Norway) As king of Norway St Olaf established Christianity there and endeavored to achieve national unity He was killed in battle in 1030 and became the nation's patron saint in 1164

August (first Monday) Bank Holiday (England) Other bank holidays established by the Act of 1971 are Easter Monday Whit-Monday and Boxing Day (December 26) All banks close and all business is suspended

Aug 6 Independence Day (Bolivia) On this day in 1925 Bolivia declared its independence of Peru

Aug 10 Independence Day (Ecuador) The first blow for independence from Spain was struck on Aug 10 1809

Sept 7 Independence Day (Brazil) Freedom from Portuguese rule was declared by Brazil on this day in 1922

Sept 11 Harvest Festival (England)

Sept 15 Independence Day (Central American Republics) Spanish rule was overthrown by these republics in 1821

Sept 16 Independence Day (Mexico) On this date in 1810 Miguel Hidalgo, a parish priest rang the bell of his church and urged the independence of Mexico from Spain The revolt ended successfully in 1822

Sept 18 Independence Day (Chile) Chile rose against Spanish rule on this day in 1810

Sept 20 Unification Day (Italy) On this date in 1870 the Italian forces entered Rome establishing national unity

Oct 10 Independence Day (China) Revolts that led to the establishment of the republic began on this date in 1911

Oct 31 Posting of Luther's Theses (Germany) On this date in 1517 Martin Luther posted his 95 theses

THE FEAST OF LANTERNS



This feast brings the Chinese New Year period to a close. It provides a gay spectacle. This woman with her two small attendants is queen of a celebration in San Francisco's Chinatown.

Nov 3 Independence Day (Panama) Panama declared its independence of Colombia on Nov 3 1901

Nov 5 Guy Fawkes Day (England) The plot of Guy Fawkes to blow up King James I and his Parliament was discovered on this day in 1605 (see Fawkes Guy)

Nov 9 Lord Mayor's Day (England) An elaborate parade and show marks the occasion on which the Lord Mayor of London takes his oath of office

Nov 10 Luther Day (Germany) Celebrations are held by Protestants on the birthday of Martin Luther (born 1483)

Nov 11 Martinmas (Germany and England) This ancient festival which was observed by the Romans as Vinalis the celebration of the vintage season, is now in honor of St Martin the patron saint of reformed drunkards. Fair weather at this season is called St Martin's summer

Nov 16 Gustavus Adolphus Day (Sweden) Sweden's great king died on this date in 1632 in the Battle of Lützen

Dec 31 Hogmanay Day (Scotland and northern England) This is observed by exchanges of gifts among the older people and gifts of cakes to children Hogmanay is supposed to be derived from an old French term for new year

RELIGIOUS OBSERVANCES AND FESTIVALS

<i>Dec 25 Christmas</i>	<i>Aug 6 Transfiguration</i>
<i>Jan 1 New Year's</i>	<i>Aug 15 Assumption</i>
<i>Jan 6 Epiphany</i>	<i>Nov 1 All Saints</i>
<i>March 25 Annunciation</i>	<i>Nov 2 All Souls</i>
<i>Dec 8 Immaculate Conception</i>	
Some Famous Saints' Days	
<i>April 25 St Mark</i>	<i>June 29 Sts Peter and Paul</i>
<i>April 30 St Catherine of Siena</i>	<i>July 15 St Swain</i>
<i>May 16 St John of Arc</i>	<i>July 25 St James the Great</i>
<i>June 6 St Boniface</i>	<i>July 26 St Christopher</i>
<i>June 13 St Anthony</i>	<i>Sept 21 St Matthew</i>
<i>June 24 St John the Baptist</i>	<i>Oct 18 St Luke</i>
<i>Nov 30 St Andrew</i>	<i>Nov 22 St Cecilia</i>

Moveable Feasts and Fasts

Shrove Tuesday Tuesday before Lent
Ash Wednesday First Day of Lent
Lent Period of forty days not including Sundays and ending with Easter

Palm Sunday Sunday before Easter
Maundy Thursday Thursday before Easter
Good Friday Friday before Easter
Easter Sunday First Sunday after the first full moon after the vernal equinox (see Easter)
Ascension Day Forty days after Easter
Whit Sunday or Pentecost Fifty days after Easter
Trinity Sunday Sunday after Whit Sunday
Corpus Christi Thursday after Trinity Sunday

Jewish Holidays

Pasover March or April
Pentecost Fifty days after Pasover
Rosh Hashana (New Year) September or October
Yom Kippur (Day of Atonement) September or October
Fest of Tabernacles September or October
Hanuka or Feast of Dedication (Feast of Lights) About winter solstice (December 21)
Purim (drawing of lots) Usually in March

LORDS and VASSALS—*The Feudal Age in EUROPE*

FEUDALISM. If one could travel over western Europe as it was a thousand years ago, one would see a succession of woods and farms, farm villages with clusters of houses, gloomy castles, a few walled towns, and now and then a well-protected monastery. Dominating the landscape were castles, the fortified homes of the powerful feudal barons. They controlled the land, which was then the principal source of wealth. Most of the people who tilled the soil and many of the traders and craftsmen in the towns were serfs and villeins, bound to the land, and governed by the landlords, to whom they owed labor as well as taxes.

Origin of Feudalism

How did these peculiar arrangements come about? To understand their beginnings, we must go back to

attacked, and without mercy killed and pillaged. (See Northmen.)

The government of the empire was helpless to defend the people. Even if the place of attack could be discovered in advance, soldiers of the emperor could not move from place to place quickly enough to help. Internal difficulties also weakened the central government. Since the all-important problem of the times was that of defense against the invaders, any landlord who was enterprising in repelling their attacks or fortunate in escaping their ravages was regarded as the natural leader or protector of the community. Sometimes he took advantage of his power to gain control of the lands of his neighbors. Smaller landowners usually gave up title to their

A VASSAL "DOING HOMAGE" IN FEUDAL DAYS



Here is a vassal kneeling before his feudal lord, with both his hands placed in those of his lord. He says, "Sire, I become your man from this day forth, of life and limb, and will hold faith to you for the lands I claim to hold from you; and I will serve you in all ways that a free man should." Then the lord raises him to his feet, and the vassal swears his "oath of fealty," after which the lord "invests" him with or puts him in possession of, his "fief" by handing him that lance which the nearest man-at-arms holds. In return for his fief the vassal performed military service for his lord. Notice the helmets and coats-of-mail worn in this picture, and also the furnishings of the lord's great hall, especially the hooded fireplace in the background.

the break-up of the ancient Roman Empire. During the barbarian invasions, beginning in the last part of the 4th century A.D., indescribable confusion prevailed. For a time, it seemed likely that the Roman authority was to be restored by the Franks, whose great king, Charlemagne, was crowned emperor of the Romans in 800. Again, however, the central government was broken up by invading barbarians. Northmen came from Scandinavia. They were expert seamen as well as warriors, and they moved swiftly in their small boats along the coasts into the harbors, and far up the rivers. Here today, yonder tomorrow, without warning they

lands but continued to use them. As a result, a new set of customs arose that determined the relations between the different classes.

Local landlords were still regarded as subjects of the central government, whether headed by a king, as in France, or by an emperor, as in Germany. In feudal terms they were called *vassals* and the lords were called *suzerains*. A *fief* was a tract of land granted by the suzerain and held by the vassal. The same person might be both suzerain and vassal. The king of England was suzerain in relation to the nobles, bishops, and abbots who held land from him in England as his vassals; but in France, he held land as the

vassal of the king of France. A nobleman who had a large tract of land might divide it and grant portions to vassals, and thus he would be vassal of the king but suzerain of those to whom he granted fiefs.

Elements of Feudalism

Feudal customs were determined by three main ideas. One of these concerned the basic form of property, the fief. It grew out of the *beneficium*, a form of landholding in which the owner gave his land to some greater landlord, to the church, or to the king, with the understanding that he would receive from the new owner the right to use the land. Title to the fief became hereditary. Usually it went to the oldest son in accordance with the law of *primogeniture*—the right of the eldest son to inherit all the land.

The second controlling idea in feudalism determined the personal relations between suzerain and vassal. In the early Feudal Age, when a smaller landlord gave up title to his land in return for protection from the dangers of the age, the process became known as *commendation*. The lesser man became his lord's man and promised loyalty. Thus there grew up one of the most distinctive ceremonies of the Feudal Age—*homage*. By this ceremony (which got its name from the Latin word *homo*, meaning "man") the lesser lord became the man or vassal of his overlord or suzerain to whom he swore fealty. He agreed to fight for his lord, to furnish soldiers in proportion to the size of his fief and to give "aids" in money on special occasions, such as the knighting of the lord's eldest son and the marriage of his eldest daughter. Protection was viewed as the chief obligation of the suzerain, and personal loyalty, expressed particularly in the duty to fight for his suzerain, was the main obligation of the vassal.

The third basic idea in feudalism determined the government. The powers of the feudal lords, like their personal relations and their peculiar land titles, grew out of older customs and institutions. One of these was known as *immunity*. As the difficulty of maintaining strong central governments increased, kings and emperors depended more and more on vassals to maintain order, and often granted them freedom, or "immunity," from the central authority. Immunity was sometimes secured by purchase. Often during the confusion of the invasions and the break-up of Charlemagne's empire, landlords became independent and governed their estates as self-sufficient rulers without formal grants of immunity. They maintained soldiers, collected revenues, held courts, and even coined money. Most people knew little of government except that of their landlords.

The church owned great tracts of land, and so churchmen became vassals of emperors, kings, and barons. This feudalizing of church lands caused churchmen to occupy a twofold position. As vassals, they owed allegiance and feudal obligations to their suzerains, the kings and emperors. But they were also officials of the church, and as such they recognized the pope as the supreme authority. The pope held that kings and emperors must not tax the church,

must not try to control appointments and must not require of churchmen homage or fealty. The resulting clash continued beyond the age of feudalism. It was echoed in the dispute of Italy and the Vatican (see Papacy).

Feudalism in the narrow sense was limited to the fief and the system of land tenure associated with it, to the personal relations of vassals and suzerains, and to the immunities and governmental powers of the lords. The peasants were the serfs and the villeins. The distinction between the two classes is hard to establish. They usually lived in villages or manors with several hundred acres of land. Their huts were made of rough timbers, and the cracks were chinked with mud, straw or rubbish. The roofs were usually thatched. The fireplace was simply an open space near the center, with no chimney. The floor was strewn with straw, leaves, rushes, or rubbish. There were few furnishings and utensils. If the owner lived on the manor, he had a large house with inclosed gardens and fields. Usually there was also a church with a priest's house. Somewhere about the manor one would find a mill, a forge or crude blacksmith's shop, and a bakehouse.

The lands of the manor included woodland and pasture as well as fields. There were usually three fields. Each field was divided into strips, and each peasant had the right to cultivate a number of strips in different parts of the manor (see Agriculture). The part of the land that the lord of the manor kept for his own use was cultivated by the peasants in return for the right to till their own strips.

In contrast with the vassals, who owed only military or "noble" services to their suzerains, the villeins and serfs had to serve the lord of the manor by doing various kinds of manual work. They also had to turn over to the lord a large part of their crops (see Slavery and Serfdom).

The village was almost entirely self-sustaining. Salt, millstones and a few iron tools and utensils were brought in, but nearly all the clothing, shoes, tools, building materials, furniture, and household equipment were made by craftsmen who lived about the castle. Disputes between villagers were settled by the lord of the manor or his agent or by the village court. Villagers rarely went many miles beyond their place of birth.

The castle folk lived in a different world. They had to depend to a large extent on local resources, but they had the best of everything and came into touch with the larger world. Tradesmen brought in the finer goods that were made in the larger towns, and also the spices, jewels, and silks imported from distant eastern countries.

The castle was not only a home, but also a fortress, a prison, a storehouse, and a workshop of arts and crafts. It was also the capital from which the lord of the castle governed his barony—the various villages, markets, and perhaps towns that made up his estates. The lord of the castle collected the surplus wealth of his dependents, and the castle folk spent it. In the

neighborhood of some of the castles, markets and fairs were held, and occasionally towns grew up about them. (See Castle.)

For the young people of the aristocracy a system of training, known as chivalry, took the place of school and college. It had very little to do, however, with intellectual life, but was for the purpose of giving children, especially boys, training in horsemanship, handling of weapons, and social usages. It gave rise to the idea of the gentleman in the narrow sense as a member of the landed aristocracy. It taught that a gentleman should protect the weak of his own class, should be courteous to women of equal rank, and loyal within the limits of his own social group. Limited as they were, the ideals of chivalry somewhat counteracted the violence and brutality of an age of perpetual conflicts. (See Knighthood.)

Feudalism was essentially a method of organizing local defenses. The privileges of feudal lords originated as reward for their assuming the responsibilities of fighting and governing during a period when the central government failed to meet the needs of the people. But, once having secured their privileges of owning the land and of taxing the peasants, they built up a system of customs, laws, and social relations which endured long after the period of invasions and disorder.

Why Feudalism Passed Away

But various forces were slowly working against feudalism. After the 13th century they brought about its decline in one country after another. In western Europe, the kings, especially in France and England, were important factors in its overthrow. During the Feudal Age, they depended for their soldiers, their officials, and their revenues mainly on their vassals. Hence, there was almost continuous conflict between kings and vassals—a conflict that is illustrated by the case of King John in England. When he tried to interpret feudal customs in his own favor, the vassals united against him. In 1215 they forced him to sign the Great Charter, which defined and limited the powers of the king over his vassals (see Magna Carta). Edward I and later kings secured the support of the rising middle classes and commoners, and feudalism as a system of government in England was doomed.

As a military system, feudalism broke down because of two innovations. One was gunpowder, which ren-

dered castles and armor useless (see Gunpowder). The other was the national standing armies of nonfeudal soldiers built up by the kings.

Furthermore, the feudal lords were extravagant, and careless in maintaining their estates. They spent vast sums on the Crusades, and in various other ways their wealth passed to the merchants and craftsmen.

The age of agriculture, on which feudalism depended, yielded to the age of commerce. Towns and cities grew in importance and power, and gradually wrested privileges and liberties from the nobles.

By the beginning of the 14th century these and other changes had undermined the feudal system, and national governments were beginning to take its place (See also Middle Ages.)

FIBERS. If man had not long ago discovered how to weave fibers into cloth, we would still be wearing skins. We need fibers also to make yarn thread, rope, twine, rugs, mats, paper, brushes, and hats, to stuff pillows and mattresses; and to make chemical compounds. Wood and cotton fibers are the raw materials of the cellulose industries (see Cellulose).

Fibers of vegetable origin are the most important in the world's economy. They are usually considered under four categories: *hard fibers*, *soft fibers*, *short (or seed) fibers*, and *miscellaneous fibers*. Hard fibers are the leaf fibers of various plants and trees, most of them tropical. Abacá, the most important, is from the leaves of a banana-like tree. Four others—sisal, henequen, cantala, and Tula istle—are from the lance-shaped leaves of various species of agave. Bahia piassava, erin végétal, toquilla, and raffia are from palms, and piña is the leaf fiber of the pineapple. Soft fibers (often called *bast*) are produced mainly in the temperate regions. They come from the inner bark of the stems of various plants. Seed fibers, such as cotton and kapok, are borne in pods much as milkweed down; these fibers are only one cell thick. Fibers such as broomroot, coir, and treebeard fit in no ordinary classification. Broomroot is from the stiff roots of a Mexican plant; coir is the husk fiber of the coconut; and treebeard is simply the Spanish moss of the American South. In addition to those mentioned, scores of other vegetable fibers find limited use.

The world also uses fibers of animal and mineral origin, as well as the increasingly important syn-

MEDIEVAL PEASANTS PLOD TO A MARKET TOWN



The man carries a sack of produce. Fowls hang from the horse's neck. This 15th-century copper engraving is by Martin Schongauer.

SOME IMPORTANT VEGETABLE FIBERS

NAME	CHIEF GROWING AREAS	PRINCIPAL USES
Hard Fibers		
Sisal	Africa Indonesia Haiti Brazil	Band twine bagging floor coverings
Henequen	Mexico Cuba El Salvador	Band twine
Abaca	Philippine Islands Indonesia Haiti Brazil	Manila rope paper
Cantala (maguey)	Java Philippine Islands	Twines
Tula retle	Mexico	Brushes coarse textiles
Bahia pisanava	Brazil Venezuela	Coarse brooms brushes
Crun végétal	Northern Africa	Upholstery stuffing
Toquilla	Ecuador Colombia	Panama hats
Rafia	Madagascar	Basketry
Pina	Philippine Islands	Fine fabrics
Soft Fibers		
Flax	Russia Belgium France Netherlands	Linen fabrics cigarette paper
Hemp	Asia Europe North America South America	Twines rope oskum coarse textiles
Jute	India Pakistan	Burlap bagging rugs
Ramie	China	Upholstery and drapery fabrics gas mantles
Short Fibers		
Cotton	United States India China Egypt	Cotton fabrics batting cellu- lulose products cordage
Kapok	Java Central America	Life preservers upholstery and mattress stuffing in sulation
Miscellaneous Fibers		
Broomroot	Mexico	Stiff brushes
Cour	Pacific Islands	Brushes floor mats
Treebark	United States	Upholstery stuffing

thetic fibers. The most important animal fibers are wool from sheep, silk from the cocoon of the silk worm and the hair of the horse, goat, rabbit, alpaca, vicuña, cow, camel and of man. Fibers of mineral origin include gold and other metallic fibers and asbestos. Among the most important synthetic fibers are rayon and other man-made cellulose fibers, cotton, nylon, Dacron and Fiberglass. (For additional material on fibers see Fibers in FACT INDEX.)

FIELD, CYRUS WEST (1819-1892) An American businessman. Cyrus Field will always be known as the man who laid the first Atlantic cable. He was a brilliant and persuasive organizer with a determination that overcame repeated failures. In laying the cable, Field knew that it would aid business and hoped that it would also bring understanding between the people of Europe and America.

One of ten children of a clergyman, Field was born Nov. 30, 1819, at Stockbridge, Mass. Three of his brothers became well known: David Dudley Field as a lawyer, Henry Martyn Field as a clergyman and writer, and Stephen Johnson Field as a Supreme Court Justice. When Cyrus was 15 he got a job as an errand boy in New York City, and after a few years an older brother helped him get started in the paper business. He rose rapidly and at 33 was able to retire with a for-

tune of a quarter of a million dollars. He had married Mary Bryan Stone in 1840; they had seven children and lived to celebrate their golden wedding anniversary.

In 1854 Field became interested in a projected telegraph line between St. John's Newfoundland and the mainland. This would speed receipt of European news by several days. While working on this project the more ambitious scheme of a transatlantic telegraph cable occurred to Field. He enlisted the support of Matthew Maury, the oceanographer and of Samuel F. B. Morse. Obtaining a government charter, he set about to raise money in England and the United States and to get government aid. The British and American governments each supplied a steamship for laying the cable and agreed to pay large sums for the transmission of official messages.

After three expensive and discouraging failures, the cable was completed in 1858. Queen Victoria and President Buchanan exchanged messages and a public celebration was held. In a few weeks time, however, the

cable went dead. Field raised more funds and with an improved cable made his next attempt following the Civil War. After one failure, a well-functioning cable was finally laid in the summer of 1866 from the deck of the S. S. Great Eastern.

In later years Field took part in railroad promotion and philanthropic projects. He was a wealthy man but only shortly before his death he learned that much of his fortune had been lost by untrustworthy financial agents. He died July 12, 1892, in his country house at Irvington-on-Hudson near New York City.

FIELD, EUGENE (1850-1895) Whimsy and caustic humor characterize the literary work of Eugene Field. During his lifetime he wrote more than 7 million words of prose and poetry. Almost all of these first appeared in his various newspaper columns.

Field, the son of New England parents, was born in St. Louis, Mo. His mother died in 1856 and his father sent him and his brother Rowell to a cousin, Mary Field French of Amherst, Mass. During the scholastic year of 1868-69 Eugene attended Williams College. When his father died in 1863, his guardian transferred him to Knox College in Illinois, and the following year he joined his brother who was attending the University of Missouri.

For a brief time Field tried, with little success, to be an actor. Then, with a part of his inheritance, he started on a tour of Europe. Before leaving he became engaged to Julia Sutherland Comstock, who was then only 14. In the fall of 1873 he returned and they were married. The marriage was a happy one, and the Fields had seven children, six of whom were boys. They provided inspiration for many poems.

Field worked on newspapers in St. Joseph, St. Louis, and Kansas City in Missouri; in Denver, Colo.; and in Chicago, Ill. He came to the staff of the *Chicago Morning News* (later the *Record*) in 1883. His column, "Sharps and Flats," became known throughout the country. His best-known books are 'A Little Book of Western Verse' (1889), 'Love Affairs of a Bibliomaniac,' with his brother, Roswell (1896), and 'The House' (1896). His poetry includes lullabies, sentimental verse, and whimsy. 'Little Boy Blue' and 'Wynken, Blynken and Nod' are still popular children's poems.

Field was a tall, thin man who disliked exercise. He was congenial and his sharp wit made him an amusing companion. His last years were troubled by illness, and he died Nov. 4, 1895, at the early age of 45.

FIG. As far back as history goes, the fig has been a dooryard tree. "Beneath the vine and fig tree" is used more than once in the Old Testament to designate "home." For centuries the fruit, fresh or dried, has formed a staple item in the diet of the people of southwestern Asia and southern Europe. A ripe fig contains a large amount of sugar and this is retained after the fruit has been dried in the sun. The juice of the fig is used to make a drink and to dye cloth; its leaves are used to polish ivory; and its bark fibers are twisted into cord.

Originally, the fig was probably a native of Asia Minor. It spread in early times to all those parts of the civilized world in which it could be cultivated successfully. All the chief varieties of cultivated figs grown today were developed in the Old World many centuries ago. The Spanish missionaries carried the fig to the New World, and by the late 1500's fig orchards were flourishing in Mexico. The dark Spanish variety, known today as the Mission fig, has been cultivated in California since early Spanish colonial days.

The Smyrna fig, however, has long been considered the best of all varieties, whether dried or served fresh. In 1880 and later, repeated attempts were made to grow Smyrna figs in California, but with little success. Young figs appeared on the trees but dropped without ripening. After some years it was discovered that the Smyrna fig must be cross-pollinated from the caprifig before its fruit will ripen.

The caprifig is the original wild fig from which the edible varieties were developed. It bears only sour and pithy fruit itself.

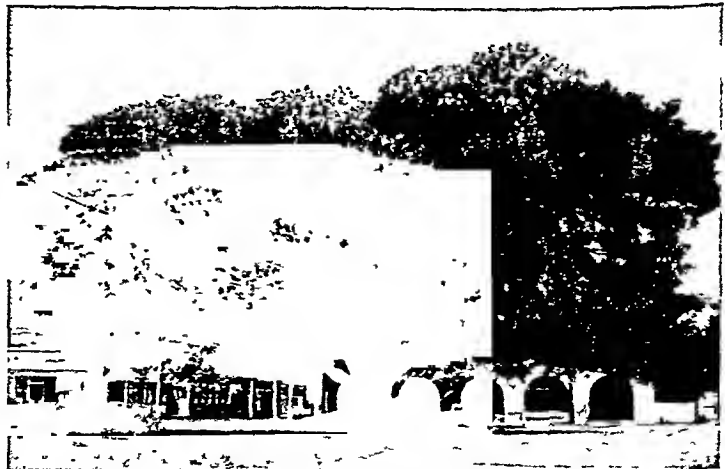
Cross-pollination occurs only through the agency of the tiny fig wasp (*Blastophaga psenes*). This is due to a peculiarity in the structure of the fig. The juicy pear-shaped figs are not the true fruit of the tree. They are rather receptacles in which the minute flowers produce the true fruit, commonly called the seeds. This receptacle is closed except for a little hole at the end. Thus cross-pollination cannot be accomplished in the usual ways—by the wind or by ordinary insects.

The fig wasps breed in the fruit of the wild fig. At the proper time bunches of these wild figs are hung in the tops of the cultivated trees. When the young female wasps push out to find a place to lay their eggs, their bodies become covered with the pollen of the caprifig flowers. As they enter the Smyrna fig, this pollen is brushed off on the flowers and fertilizes them. Since the flowers of the Smyrna fig are not suitable for their eggs, the wasps soon leave.

Thus whole process is called *caprification*. Fig growers had long known about caprification as practiced in the Mediterranean region, but they supposed it was only a superstitious custom. When its true purpose was understood, wasp-bearing caprifigs were imported and the Smyrna fig industry of California began to flourish. The first sizable crops were harvested in the early years of the 20th century. Smyrna figs are shipped from California under the trade name *Calimyrna*.

The so-called *common fig* does not require pollinizing to produce ripe fruit. The Mission is one of several varieties of the common fig. The white Adriatic fig, used largely for drying, is the most important common fig of California. Another important variety is the Kadota, an American name for the Italian Dottato fig. Kadotas are favored for commercial

A GIANT AMONG FIG TREES



Some varieties of fig trees grow to enormous size. This tree, which stands in Santa Barbara, Calif., shades nearly one third of an acre with its branches.

canning. In the Gulf states such varieties as the Brunswick or Magnolia and the Celeste are grown commercially and for home preserving.

Certain varieties of figs such as the White San Pedro mature one crop of fruit without pollinization but require caprification for the second crop. All varieties of figs may be caprified in some cases; however the caprified fruit though larger is inferior to the uncapped fruit.

The many varieties of figs differ greatly, some being low trailing vines, some bushes and others large trees. The fruits vary in color from deep purple to yellow or nearly white. The Smyrna fig is a small bushy tree and rarely grows more than 18 or 20 feet high.

In favorable climates the fig tree produces three or more crops a year, each on distinct shoots. The trees grow readily from cuttings and are also propagated by budding, grafting and seeds. They shed their leaves and are dormant during the winter. The large beautiful leaves are palmately veined, three- to five-lobed, wavy margined and somewhat rough and leathery.

The scientific name of the fig is *Ficus carica*. The wild fig and all edible types are simply varieties of this species. The caprifier is called *syctestris*. The three types of cultivated figs are sometimes designated *smyrnensis* (Smyrna fig), *hortensis* (common fig) and *intermedia* (varieties of the White San Pedro type). The genus *Ficus* is a large one and also includes many ornamental and shade trees of the tropics such as the banyan, the bo tree and the household rubber plant. (For pictures of the espurfig and Smyrna fig in color see Fruits.)

FIGURES OF SPEECH When you say that the athlete ran like lightning, that someone who talks too much is a windbag, or that you are dying with curiosity, you are using figures of speech. You are saying things which are not strictly true, but which make your descriptions more vivid than literal expressions could be. Another name for figure of speech is *trope*. The Greek word for turning—a turning of words from their usual meaning or order for the purpose of clearness, emphasis or beauty.

Figures That Show Comparison

Two of the most familiar figures of speech are the *simile* (*sim-ile*) and the *metaphor* (*met-a-fer*). A simile is a figure of speech in which comparison between two entirely different objects is expressed by the use of such words as *like* or *as*. Wordsworth used a beautiful simile when he said of Milton:

Thy soul was like a star and dwelt apart. This gives us a vivid impression in few words of Milton's loftiness of spirit and his love of solitude.

In a metaphor the comparison is implied rather than expressed. Here the connecting word *like* or *as* is not used; we simply say that one object is another—for example, "His head is a sieve." Shakespeare used a metaphor when he said:

All the world's a stage
And all the men and women merely players.

Metaphors are more forceful than similes, but they must be used carefully. Otherwise we run the risk of becoming involved in *mixed metaphors*. Here the figurative language instead of going on with the picture which the comparison calls up, leads into an entirely different and ridiculous idea—for example, "The pale hand of death stalked into our midst."

Allegory is actually a sustained type of metaphor. In using it a writer makes imaginary beings and events stand for real ones or for philosophical ideas. Famous examples are Bunyan's *Pilgrim's Progress* and Spenser's *The Faerie Queene*.

Another figure that uses comparison is *personification*—giving human characteristics to an inanimate object. Thus the Irish poet *Æ* wrote: "Dusk wraps the village in its dim caress," and Byron said: "Lake Leman wooed me with its crystal face."

Exaggeration and Understatement

When we exaggerate to produce a vivid impression we use *hyperbole* (*hi-per-bō-le*). This figure is often used unconsciously in everyday speech. We say we have not seen a friend for ages, or that an unhappy person wept buckets of tears. Hyperbole is a chief characteristic in American humor. Washington Irving used it effectively in picturing Ichabod Crane with "hands that dangled a mile out of his sleeves" and feet that might have served for shovels.

Understatement is the opposite of exaggeration; it is also used for special effect—to make a statement more emphatic by deliberately weakening or minimizing it. The commonest form, technically called *litotes* (*li-tō-tes*), is the use of the negative to emphasize a positive statement—for example, "That's not a bad idea" or "He is nobody's fool." Other forms of understatement or *meiosis* (*mi-ō-sis*) are frequent in colloquial speech. Examples are the late unpleasantness (a recent war) and crossing the pond (crossing the Atlantic Ocean). Understatement is one of the most characteristic features of British humor, but American humorists such as Mark Twain have also made frequent use of it in their writings.

Other Figures of Speech

There are many other figures of speech (also called figures of rhetoric) used for various rhetorical effects. These include *antithesis*, *irony*, *euphemism*, *epigram*, *metonymy*, *synecdoche*, *climax* and *onomatopoeia*. All these, with definitions and illustrations, may be found under their own names in the Fact-Index.

Figures of etymology are contractions or elisions such as *never* for *never* and *twill* for *it will*. Figures of syntax are deviations from normal sentence structure. These include the use of words out of their regular order as "We climbed a mountain high" and the omission of words to gain force as "for example."

On guard for Be on your guard.

FIJI (je-ge) ISLANDS Gleaming white buildings, the whir of motor cars and the bustle of a busy port greet the visitor who disembarks at Suva, capital of Fiji. This group of South Sea islands, once notorious as a home of cannibals, is now a progressive and law-abiding colony of Great Britain.

SUVA, CAPITAL CITY OF THE FIJI ISLANDS



The capital of the British colony of Fiji in the South Pacific is Suva. It is a bustling little tropical city, for the Fiji Islands lie on several of the main air and sea routes across the Pacific Ocean.

The Fiji group is about 600 miles southwest of Samoa and 1,150 miles north of New Zealand. It lies on the main air route between the United States and Australia and New Zealand. The group is composed of more than 300 islands, of which only about 100 are inhabited. The larger islands are of volcanic origin; the smaller ones are coral atolls. The largest, Viti Levu, on which Suva is situated, is 93 miles long and 67 miles wide; the next in size is Vanua Levu, 117 by 30 miles. On Viti Levu, as on the other larger islands, the coast hills—vividly green with huge vine-wrapped trees and great reeds—rise to rugged peaks, many of them more than 3,000 feet high. Many rivers, which often become swollen by torrential rains, cut the fertile valleys. The chief river, the Rewa on Viti Levu, is navigable for about 50 miles. For the tropics, the climate is cool, with temperatures ranging from about 60° to 95° F.

The discovery of Fiji is usually credited to Abel Jansen Tasman, a Dutch navigator, who visited the group in 1643. For almost two centuries vessels fearfully avoided the beautiful islands which thundered with the roll of cannibal drums. But in 1835 missionaries began the work of civilization, and much of the progress made by the people is due to their

labors. In 1874 Thakombau, famous "king of the Cannibal islands," who had been converted to Christianity by the missionaries, put Fiji under British rule. Although occasional cannibal feasts occurred as late as 1890, the missionaries and the British soon made Fiji commercially one of the most important of the Pacific island groups.

Character of the People

The Fijians are tall, bronzed, and strongly built, with frizzy mops of black hair. They are a childlike people—gay, gentle, and almost without ambition. They live in a placid communal society. Every Fijian has a right to a piece of the land belonging to his tribe. He is content to support his family by his little crops. Large tasks, such as building the thatched huts, are done by the village as a whole. Under the strict medical care of the British, the islanders have increased in population—a rare happening on Pacific islands that have been exposed to the diseases of white men. Free

medical service, numerous schools, including a medical school, and a child welfare program have been established by the government.

The chief export is cane sugar. A British refining company controls production. The company leases land to growers, chiefly immigrants from the Indian peninsula. Other major exports include gold bullion, copra, molasses, bananas, and shells for buttons. Minor exports include coconut oil, gum, smoked sea cucumbers (trepan), cotton, and turtle shell.

Fijians produce most of the copra and bananas, but blandly refuse to work steadily in other industries. To develop Fiji, the British imported Chinese and Indian laborers. The total population of the Fiji Islands is 259,638 (1946 census). Indians number 120,063; Fijians, 117,488; Europeans, 4,694. The rest are mainly Chinese, Polynesians, and Melanesians.

Fiji is ruled by a British governor and a legislative council made up of British, Indian, and Fijian members. District councils consist of tribal chiefs and village headmen. During the second World War many Fijians served the Allied forces as skillful scouts in western Pacific island campaigns. (For map showing location of Fiji Islands, see Pacific Ocean.)

The Thirteenth PRESIDENT of the UNITED STATES

FILLMORE, MILLARD (1800-1874). Upon the death of President Zachary Taylor in 1850, Millard Fillmore, his vice-president, succeeded him in office. The period was a stormy one, for a bitter debate on the slavery question was raging. A hostile Congress handicapped Fillmore's able and conscientious efforts, and his policies were not popular enough with the people to win him a second term.

Fillmore was born in a log cabin on a frontier farm in Cayuga County, N. Y. When he was 14 years old,

his father apprenticed him for seven years to a wool carder, who proved to be a brutally cruel master. Two years before his term of apprenticeship was finished, Fillmore decided to study law. So he "bought his time" for \$30, and went to Buffalo. There he persuaded a lawyer to let him work in his office for room and board. To earn money for other expenses he taught school, although his own formal schooling had ended when he was 14 and had been limited to three months each year.

After eight years in a law office he was admitted to the bar in 1827 and began to practice law at East Aurora N Y. He returned to Buffalo in a few years and by 1840 his law firm was one of the best known in the state. Though Fillmore was never a brilliant lawyer, he was a conscientious worker and had a sound legal knowledge.

His political career began with the birth of the Whig party, to oppose the Democratic party of Andrew Jackson and it ended with the death of that party on the eve of the Civil War. The first time he was elected to office was in 1828 when he was chosen a member of the New York legislature the last was in 1848, when he was elected vice-president of the United States.

Fillmore's Record in Public Life

In the legislature Fillmore's chief service was in securing the passage of a law to abolish imprisonment for debt in New York. In Congress where he served several terms (1833-1835, 1837-1843), he was author of the tariff law of 1842, which provided high duties on imports. To him also was due the appropriation by Congress of \$30,000 to aid Samuel F B Morse in perfecting his invention of the telegraph. On the burning question of slavery he pursued a moderate course, keeping free from pledges to either side. This made him acceptable to both Northern and Southern Whigs and led to his election as vice-president with Gen Zachary Taylor in 1848.

As vice president he was called upon to preside over the Senate during one of the stormiest debates in the history of the country, that on the slavery compromise measures of 1850. Since 1826 no vice-president had made an attempt to call the senators to order when they became too heated in debate, but during this debate Fillmore resumed the right. His position was made difficult by the fact that his attitude of concession to the slaveholding South differed from that of President Taylor.

How He Became President

In the midst of the debate Taylor died and on July 9, 1850, Millard Fillmore became the 13th president of the United States and the second "accidental president" who had succeeded to that office from the vice-presidency. He formed a new cabinet with

Daniel Webster as secretary of state. The compromise measures now had the President's backing and it was found that by voting for each measure separately a majority could be reached. So they were soon passed and Fillmore signed them because he

felt that only through them could the Union be preserved (See Compromise of 1850).

His signature to the new Fugitive Slave Law, which was part of the compromise, lost him the support of the northern members of the Whig party and cost him re-election in 1852. During the continuance of the slavery dispute it was impossible for any president to suit both North and South and no president from Jackson to Lincoln served more than one term.

As Fillmore was a Whig and Congress was Democratic little important legislation was passed except the Compromise. But in foreign affairs an important step was taken in the dispatch of an expedition under Commodore Perry to

Japan. This began the negotiations for the treaty of 1854 which opened Japanese ports to American vessels and paved the way for the introduction of Western civilization into that kingdom.

The great Whig leader Henry Clay on his death bed had recommended that President Fillmore be re-nominated in 1852, and Daniel Webster said that his administration was one of the ablest that the country had known for years. But the Southern Whigs were lukewarm, and many of the Northern ones bitterly opposed him as a 'Silver Gray' or Cotton Whig. So he was passed by in the convention and the nomination given to Gen Winfield Scott, a national hero. Scott however was de-

feated by Franklin Pierce, Democratic candidate (see Pierce, Franklin Scott General Winfield).

The Passing of Fillmore and the Whigs

At the next election, in 1856 the expiring Whig party, in alliance with a party called the "Know Nothings," thought better of their neglect and made Fillmore their presidential candidate but he was badly defeated at the polls by the Democratic candidate James Buchanan. He obtained the electoral vote of only a single state, Maryland. This was Fillmore's last appearance in public life, though he main-



MILLARD FILLMORE

FILLMORE'S ADMINISTRATION 1850-1853

Webster made Secretary of State
Compromise of 1850, including new Fugitive
Slave Law

Maine adopts prohibition (1851)
Postage reduced from 5 to 3 cents (1851)
Clay and Webster die (1852)
'Uncle Tom's Cabin' published (1852)
Perry's mission to Japan (1853)

tained his interest in political affairs until his death, 18 years later.

In spite of his lack of early advantages, President Fillmore had "a grace and polish of manner which fitted him for the most refined circles." When he visited England in 1855 he was offered the degree of D.C.L. (Doctor of Civil Law) by the University of Oxford, an honor which he declined. His last years were spent in his luxurious home in Buffalo, in striking contrast to his boyhood days.

FINCH. Small, stout birds with conical bills adapted to crushing seeds belong to the finch group. They are closely related to the grosbeaks, sparrows, and buntings. All of them are members of the family *Fringillidae*. This is the largest of all the bird families. Its members are found throughout the world, except in the Australian region.

The ground dwellers, such as the sparrows, are streaked brown birds. Of the tree dwellers, the males are richly colored. The females and young males show their relationship to the sparrows by their streaked brown plumage. Most of them are fine singers. All are valued by farmers and gardeners because they destroy weed seeds. Because of their preference for seeds they can find winter food more easily than the insect eaters can. Hence they do not make long migrations. They are the chief winter residents in the Northern states.

Among the birds that go by the name of finch, perhaps the best known is the goldfinch (see Goldfinch). The male purple finch is not purple but a rich shade of raspberry red. This finch nests in lawn trees as well as in forests, from northern Canada to the Northern states. It winters south to the Gulf coast.

The house finch is a familiar and well-loved Western bird. The male has brownish-gray upper parts washed with red, and rosy forehead and rump. These friendly, musical little birds nest about houses in any tree, vine, cactus, or sagebrush plant available.

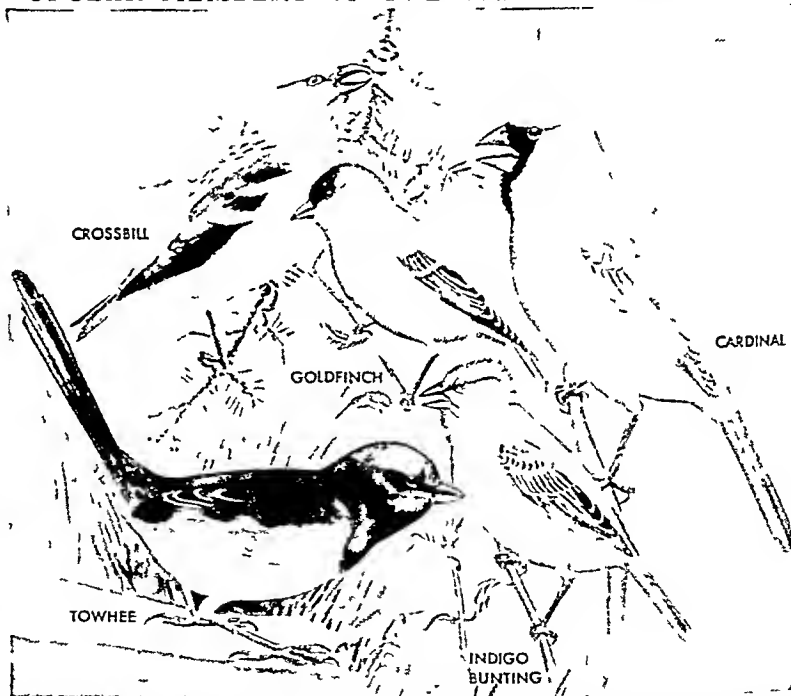
A curious finch is the crossbill. The tips of the bill overlap. With one stroke of the beak, the bird can open the husk of a pine seed. One can usually locate a flock of crossbills in the thick branches of evergreens by watching for the discarded husks on the ground below the trees and listening for the soft clicking

of the bills as they break the seeds open. These birds are dull brick red.

The slate-colored junco of eastern North America is one of the most abundant visitors to winter feeding stations. It nests in northern forests. There are several different species in the West, among them the Oregon, white-winged, pink-sided, red-backed, and gray-headed juncos.

The red-eyed towhee is a common summer resident of the central and northern United States. It feeds on the ground by scratching furiously with both feet to stir up seeds and insects. It is a large bird, about eight inches long, with black head, chest, and upper parts, chestnut-brown sides, and white-tipped tail (For picture in color, see Birds) The name comes from the song, which sounds to some people more like *dr-r-rink' your tea-ee-ee*. Another name is *chewink*, from the call note. In the Western states are the spotted, green-tailed, and canyon towhees.

POPULAR MEMBERS OF THE GREAT FINCH FAMILY

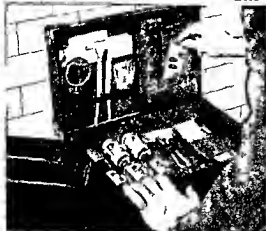


The finches are members of a large and varied family which includes the modest, brown sparrows as well as the colorful birds shown above. All are valuable destroyers of weed seeds. Many of them nest in the shade trees or woody underbrush of city lawns and vacant lots; others are frequent visitors to winter feeding stations. The noisy English sparrow does not belong to this family.

The redpoll is a small, gray-brown bird with bright red cap and rump tinged with pink. It appears irregularly in the United States in the winter.

The scientific name of the purple finch is *Carpodacus purpureus*; house finch, *C. mexicanus*; red crossbill, *Loxia curvirostris*; red-eyed towhee, *Pipilo erythrophthalmus*; slate-colored junco, *Junco hyemalis*; common redpoll, *Acanthus linaria*. (See also Bunting; Cardinal; Grosbeak; Sparrow.)

HOW THE FINGERPRINT EXPERT WORKS



This fingerprint expert's kit has special powders and brushes for developing latent prints and equipment for recording them.



Fingerprints at the scene of a crime may be photographed directly or treated so they can be transferred to paper as shown here.

FINGERPRINTS On file at the Department of Justice in Washington D. C. are the fingerprints of millions of Americans. Some people have submitted their fingerprints voluntarily. Others have been required to record their prints because they worked for the government including the armed services. Still others have been fingerprinted by the police because they were involved in crime investigations.

These files are of immense value because the fingerprints are permanent and accurate means of identifying the rowers. No two people in the world living or dead have identical fingerprints, not even identical twins. Despite growth and aging a person's fingerprints show the same pattern throughout life. It is impossible to alter the patterns of fingerprints and virtually impossible to destroy them. A criminal may change his appearance completely, an amnesia victim may forget who he is, but comparison of their present fingerprints with their previously filed impressions will positively establish their identity.

Recording and Identifying Fingerprints

The skin on the insides of the hands and the soles of the feet is different from other body skin. It is elevated into tiny papillary ridges. These ridges form

definite unique patterns. The patterns are made up of four types of lines: arches, loops, whorls, and composites. These plus their subtypes make up at least nine different kinds of patterns. The science of fingerprint classification is based on analysis of the number and sequence of lines in the different patterns presented by each person.

Fingerprints are recorded by rolling the subject's fingers on a flat surface spread thinly with printer's ink. Then on a standard card each of the ten tips is impressed in a separate square. As a check on the sequence of the rolled prints, a set of flat prints are taken for each hand, impressing all five fingers in a large square at the same time.

In crime detection work, experts deal with three types of fingerprint traces. One is the molded impression of a print left in a soft substance such as wax or putty. Another is the visible impression left by fingertips coated with grease, paint, or a similar material. A third is the latent impression left on a surface by the natural secretions from the fingertip skin. These are often nearly invisible and must be brought out by special powders. The photographed traces are compared with file prints to learn the identity of the owner.

In many maternity hospitals, footprints of infants are taken at birth to establish identity if the child's name tag is lost. Footprints are used because the fingertip ridges on the new infant are too faint to make impressions. Many types of identification cards have a place for fingerprint impressions.

FINGERPRINTS FOLLOW US THROUGH LIFE



These three groups of fingerprints all belong to the same person. They were taken at the ages of 25, 44, and 53 (left to right). Notice how the

patterns formed by the papillary ridges remain unchanged, even though the skin of the last set has been cracked and shriveled by extreme age.

“SUOMI” —LAND of the FINNS

FINLAND. In their far northern homeland, the hardy Finns have developed a vigorous and distinctive society. Freed from Russian rule by the first World War, they created a stable and progressive government.

When Russia attacked the young republic in the second World War, the Finns amazed the world by the courage and skill with which they defended themselves against overwhelming odds. They were forced to give up valuable territory and to pay enormous reparations; but they refused to become the slaves of their old masters and again set about rebuilding their country. Of all the Russian-conquered nations, only Finland has succeeded in staying outside the Iron Curtain.

Finland's Geographical Setting

Finland lies in northern Europe between Sweden on the west, Russia on the east, and Norway and Russia on the north. On the south is the Gulf of Finland, on the southwest the Gulf of Bothnia, both of which empty into the Baltic Sea. (For maps, see Europe; Norway.) The land stretches northward about 700 miles to its borders near the Arctic Ocean. The average width is 240 miles. The area is about 130,119 square miles.

It is between the same degrees of latitude as most of Alaska, northern Canada, southern Greenland, and much of Siberia. In the far north the summer sun remains above the horizon for two months. The southern ports in winter must be kept open with icebreakers.

The land, for the most part low, becomes mountainous in the northwest, where Mount Haltia rises to a height of over 4,000 feet. The glaciers of the Ice Age gouged the granite bedrock, leaving the country generally rough and stony and dotted with some 65,000 lakes. The largest are Lake Saimaa (680 square miles) and Lake Enare (550 square miles). The glaciers also left large marshy areas—hence the Finnish name for the country, *Suomi*, meaning “swamp.” But



Finland's agriculture is becoming increasingly mechanized, but many farms still use old-fashioned hay rakes. The men are pitching the hay onto iron spikes.

to the south and west lies rich clay soil, and here are the best farms and the chief cities. The coasts are fringed with about 80,000 rocky islands, including some 6,000 in the Åland group alone.

Lakes, rivers, and canals provide a vast network of waterways. Rafts of timber float down the rivers to the mills. Finland lacks coal so hydroelectric plants harness the rapids to furnish power.

The south has six or seven months of winter; the north, eight or nine months. During these months the entire land is covered with deep snow, which supplies much of the average yearly precipitation of 20 inches. In summer the sun shines 19 hours a day, and the temperature averages about 60° F., so that grains ripen in six or seven weeks.

Natural Resources and Industry

Forests of pine, spruce, and birch, the chief source of the country's wealth, cover three fourths of the land. Cutting of the timber is regulated by far-sighted conservation laws. Wood products make up four fifths or more of the value of the exports. They include pulp, plywood, cellulose, newsprint or other paper goods, and prefabricated wooden buildings of all kinds. Copper, nickel, and low-grade iron ore are mined, and granite is quarried. Copper and copper products are exported.

Manufactured goods in addit on to wood products include cotton text les produced chiefly in the city of Tampere fine porcelain and earthenware machines for the forest products industries and nitrogen fertilizers An organization called Friends of Finnish Handicraft is introducing to world markets the ceramics glass woven goods and other fine hand crafts of the country

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The People—Their Language

The Finns belong to the Finno-Ugrian language group which also includes the Hungarians It was once believed that they were Mongols of eastern Asiatic origin It is now known that the early home of the Finns centered around the Volga River valley Before the Christian Era the ancestors of the Finns migrated westward and across the Gulf of Finland to the present homeland They absorbed the Scandinavian peoples already settled there and pushed to the far north a race of nomads the Lapps (see Lapland) In later centuries Finland was a part of Sweden and many Swedes settled on the south western shores and on the Åland Islands Today both Swedish and Finnish are official languages Of the total population (1950 census) of 4 029 803 about 8 per cent speak Swedish

The Lutheran Evangelical Church is the established church to which 95 per cent of the people belong Greek Orthodox Catholics is the second largest group About one fourth of the people live in cities Helsinki on the south coast is the capital and chief

THE CAPITAL CITY HELSINKI



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seaport (population 363 834) Turku and Tampere both with populations of a little more than 100 000 and Vaasa (35 030) are the other chief cities

High Educational Level

Finland is a nation of very high culture Illiteracy is less than one per cent Attendance in public elementary schools is compulsory Secondary schools include lycées which lead to the university and middle schools with a five-year curriculum There are ten teachers colleges five state-supported schools for deaf mutes and two for the blind

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A leader in social legislation Finland was one of the first countries in the world to enforce the eight-hour working day paid holidays old-age disability and survivor's insurance for all citizens and protection of women and children in industry In 1906 it was the first country in Europe to grant women the same political rights as men The co-operative movement has penetrated every phase of the country's economic life

The Finns are an athletic people Many belong to a sports club Every farm has its sauna or steam bath usually a turf covered wooden hut separate from the dwelling where water is poured on hot stones to produce steam The bath is often finished by a plunge into snow or into a nearby icy lake

Representative Government

At the head of the Finnish government is the president He is elected for a

‘‘SUOMI’’ —LAND of the FINNS

FINLAND. In their far northern homeland, the hardy Finns have developed a vigorous and distinctive society. Freed from Russian rule by the first World War, they created a stable and progressive government.

When Russia attacked the young republic in the second World War, the Finns amazed the world by the courage and skill with which they defended themselves against overwhelming odds. They were forced to give up valuable territory and to pay enormous reparations; but they refused to become the slaves of their old masters and again set about rebuilding their country. Of all the Russian-conquered nations, only Finland has succeeded in staying outside the Iron Curtain.

Finland's Geographical Setting

Finland lies in northern Europe between Sweden on the west, Russia on the east, and Norway and Russia on the north. On the south is the Gulf of Finland, on the southwest the Gulf of Bothnia, both of which empty into the Baltic Sea. (For maps, see Europe; Norway.) The land stretches northward about 700 miles to its borders near the Arctic Ocean. The average width is 240 miles. The area is about 130,119 square miles.

It is between the same degrees of latitude as most of Alaska, northern Canada, southern Greenland, and much of Siberia. In the far north the summer sun remains above the horizon for two months. The southern ports in winter must be kept open with icebreakers.

The land, for the most part low, becomes mountainous in the northwest, where Mount Haltia rises to a height of over 4,000 feet. The glaciers of the Ice Age gouged the granite bedrock, leaving the country generally rough and stony and dotted with some 65,000 lakes. The largest are Lake Saimaa (680 square miles) and Lake Enare (550 square miles). The glaciers also left large marshy areas—hence the Finnish name for the country, *Suomi*, meaning “swamp.” But



Finland's agriculture is becoming increasingly mechanized, but many farms still use old-fashioned hay rakes. The men are pitching the hay onto iron spikes.

to the south and west lies rich clay soil, and here are the best farms and the chief cities. The coasts are fringed with about 80,000 rocky islands, including some 6,000 in the Åland group alone.

Lakes, rivers, and canals provide a vast network of waterways. Rafts of timber float down the rivers to the mills. Finland lacks coal so hydroelectric plants harness the rapids to furnish power.

The south has six or seven months of winter; the north, eight or nine months. During these months the entire land is covered with deep snow, which supplies much of the average yearly precipitation of 20 inches. In summer the sun shines 19 hours a day, and the temperature averages about 60° F., so that grains ripen in six or seven weeks.

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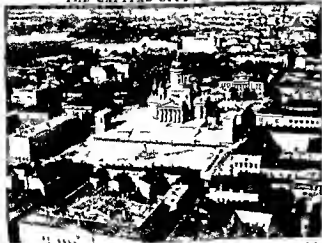
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term of six years by an electoral college of 300 electors. He appoints the seven ministers who make up his Council of State. All laws are made by the Diet, a legislative body of one chamber. Its 200 members are elected for a maximum term of three years by the votes of all men and women 21 years of age and over.

For purposes of local government the country is divided into ten departments, each headed by a prefect who is appointed by the president. Each rural parish and each town forms a commune, governed by an elected council. The national flag is a blue cross on a white field (see Flags).

A Warlike History

Brave, hardy, and warlike, the Finns enjoyed independence until 1157 when they were conquered by Sweden. Swedish rule was liberal and the individual freedom of the Finns was respected. In 1809 Russia won Finland from Sweden and made it an autonomous grand duchy. Again these independent people demanded and received respect for their own language, laws, and customs. Not until the 20th century did Russia launch a campaign of oppression and violate the Finnish constitution adopted in 1772.

In 1917 came the Russian Revolution. On Dec. 6, 1917, Finland declared its independence, and two years later it set up a republic. The new constitution was ratified July 17, 1919.

In 1939 Finland was invaded by Russia and lost strategic areas along its eastern boundary in the Karelian Isthmus. The war between the two nations was renewed in 1941. Under the armistice of 1944, Finland was forced to cede more land, including Petsamo, its outlet to the Arctic Ocean. Russia also got a 50-year lease on the Porkkala Peninsula for a naval base. In 1948 Russia cut Finland's reparations but forced it to sign a "mutual defense" pact.

Nearly half a million Karelians left their ancestral homes in order to remain Finnish nationals. The problem of resettling these "displaced persons," rebuilding their war-torn country, and paying reparations to Russia taxed the Finns' courage and determination as never before in their long history. (For Reference-Outline and Bibliography, see Europe.)

FIR. To many people the word "fir" calls to mind the graceful, fragrant balsam fir so much used as a Christmas tree. Many other firs, however, are distributed throughout the world. The timber is inferior to spruce and pine, but it is used for lumber and pulpwood. Various foreign species are popular as ornamental trees.

The balsam fir of Canada and the northern forests of central and eastern United States is a medium-sized tree from 40 to 60 feet high. It lives about 90 to 150 years. It is beautifully shaped, a symmetrical pyramid rising to a spirelike tip. It may be recognized by the flattened appearance of the horizontal branches. The needles are also flattened, dark shiny green above and silver-green below. They tend to crowd to the upper side of the twig. The cones are two to four inches long. Resin-filled hlisters on the trunk and branches are the source of Canada balsam, which

is used as a transparent cement for optical glass; for mounting preparations for the microscope; and in the manufacture of varnishes and certain medicines. The southern balsam fir, or Fraser fir, grows only in the southern Appalachian Mountains.

The western firs are larger, reaching average heights of 100 to 150 feet. They live from 250 to 350 years. White fir has the widest distribution, growing throughout the western mountains. The noble fir of the Cascade Mountains, the California red fir, the grand and Pacific silver firs are also splendid trees.

The Giant Douglas Fir

Douglas fir is not a true fir. Monarch of the Pacific northwest forests, this great tree grows to a height of 200 to 300 feet and a diameter of 10 feet. It is second in size only to the California sequoias; and it is second only to yellow pine as the most important commercial timber in the United States.

There are two forms of the tree. One grows in the forests of the Pacific coast, the other in the Rocky Mountain region. The Pacific coast tree is the larger.

True firs form the genus *Abies*. The scientific name of balsam fir is *Abies balsamea*; southern balsam fir, or Fraser fir, *A. fraseri*; white fir, *A. concolor*; Douglas fir, *Pseudotsuga taxifolia*. (See also Wood.)

THE FRAGRANT CHRISTMAS TREE



The balsam fir is a beautiful spire-shaped tree. Its green, purple-tinged cones stand upright. The needles are flat and crowd to the upper side of the horizontal branches.

WHAT FIRE IS *and* How IT SERVES MAN

FIRE When men learned to make and use fire they could start to live in civilized ways. With fire, they could cook food so that it was easier to eat and tasted better. By the light of torches men could find their way at night. They could improve their wooden tools by hardening the points in fire. With fire to keep them warm they could live in the colder regions and spread out over the earth.

It is supposed that the earliest savages obtained their fire accidentally from trees set ablaze by lightning or from spouting volcanoes and that they treasured it carefully in huts and caves. As far back

as the study of early man has gone, he has never been found without fire for warmth and cooking and for protection from wild beasts in whom it inspires terror. Later men discovered how to create fire by rubbing dry sticks together and they invented ingenious fire drills to aid the process. When they began to chip flint to make axes they learned that fire may be drawn from stone a method which developed into the flint and steel of comparatively recent times (see Matches). Still later men found out that fire could also be made by focusing the sun's rays with a lens or curved mirror.

But however much human beings turned fire to useful purposes they remained ignorant of its true character until the great French chemist Antoine Lavoisier investigated in 1783 the properties of oxygen and laid the foundation for modern chemistry (see Oxygen).

Discovering the Nature of Fire

Lavoisier was condemned to death in 1794 by the Terrorists of the French Revolution but before his death he had succeeded completely in disproving the old phlogiston theory which held that when any object was heated or cooled it was due to a mysterious substance (phlogiston) which flowed into or out of the object in question. We know today that ordinary fire is due to the chemical process called oxidation

which means the combination of a substance with oxygen. That is why fires need air to burn properly and why a flame will go out after it has used up all the oxygen in a closed vessel. Almost anything will combine with oxygen if enough time is allowed. Iron will rust if exposed long to damp air and that rust is simply oxidized iron. But when the chemical combination is so rapid that it is accompanied by a flame it is called *combustion*.

To start combustion heat is required. The degree of temperature at which any substance will catch fire is called the *ignition point* which of course varies with

the condition of the substance, the pressure of the air or the other gases involved, etc. When the savage rubbed two sticks together he discovered without knowing it that the ignition point of wood is usually quite high. In other words he had to use a good deal of muscle and create a good deal of heat before flames appeared. The tip of a match is composed of chemicals which under ordinary circumstances have a low ignition point. The heat created by scratching it once is enough to start combustion.

The ignition points of some vegetable and animal oils are

very low. They oxidize so quickly that they generate a great deal of heat and if kept in a confined place will often burst into flames. Many fires are caused by the spontaneous combustion of heaps of rags, paper, sawdust and other substances strongly impregnated with oil. Coal and charcoal stored in large piles sometimes generate enough heat to set themselves on fire. Certain bacteria thriving in moist hay often cause the temperature of the hay to rise so rapidly that the stack burns itself up.

Thus we see how a fire is started but what makes it keep burning? The answer is one of the most important laws of fire. In scientific language it is this: *A fire will be self-supporting only when the tem-*

ESKIMO MAKES FIRE WITH A BOW DRILL



The string of a small bow is wrapped around the shaft of the wooden drill with which the Alaskan Eskimo is making a fire. One end of the drill rests in a grease-filled socket in the bow, and by its rotation the drill is heated. The other end of the drill is a V-shaped depression cut into a piece of dry wood called the hearth. Sawing the bow back and forth creates a dust which falls into the hearth, so much heat is created that the dust catches fire.

perature created by the combustion of the burning substance is as high or higher than its ignition point. Some very hard woods, such as ebony for instance, require a great deal of heat to burn them. If you put the end of a stick of ebony in a coal fire it will burn, but when you draw it out the fire of the smoldering ebony itself is lower in temperature than the ignition point of ebony and the flames will die.

This principle explains why you can blow out a match. Your breath carries away the heat until the temperature falls below the ignition point of the matchstick. The stream of water from a fireman's hose cools the burning walls of a building with a similar result.

The heat of a fire depends upon the speed with which chemicals combine with oxygen. This speed in turn depends generally upon the quantity of oxygen present. If we take a bit of iron wire and touch a match to it, it will not burn. But fasten the tip of a match to the end of the wire, strike it, and plunge it quickly into a jar of pure oxygen. The wire will catch fire and burn, with bright sparks shooting off briskly.

Fires That Make No Flame

Fire may burn either with or without flames. A flame always indicates that heat has forced gas from a burning substance; the flames come from the combination of this gas with oxygen in the air. Thus, when a coal fire flames, it does so because gas is being forced from the coal and combines with oxygen. If kept from burning, such gas can be stored for future use. Manufactured gas is forced from coal in airtight kilns or retorts. The product left after the gas is extracted from coal is called coke. Coke will burn without flame because no gas is driven off. To burn, the carbon in the coke combines directly with oxygen (*see Gas, Manufactured*).

It is the gas given off by the heated wax in a candle which produces the bright flame. To prove this, blow out a candle which has been burning for some time. A thin ribbon of smoke will arise. Pass a lighted match through this smoke an inch above the wick. A tiny flame will run down and light the candle again.

The brightest flames are not always the hottest. Hydrogen, which combines with oxygen when burning to form water, has an almost invisible flame, even under ordinary circumstances. When it is absolutely pure and the air around it is completely free of dust, the hydrogen flame cannot be seen even in a dark room. The scientist who proved this fact had to feel around with his hands to find his burner. We may imagine that he had no difficulty in knowing when he reached it, for the hydrogen flame is one of the hottest of fires (*see Hydrogen*).

The Fire That Makes Gas Engines Go

When an inflammable gas is mixed with air in exactly the quantities necessary for complete combination, it will burn so fast as to create an explosion. This is what takes place in a gasoline engine. The

carburetor provides the air mixture and the electric spark sets it on fire. (*See Internal Combustion Engine*.) The occasional small explosions after the hummers of a gas stove are turned off are due to the same fact. A little gas is left in the pipe, more and more air creeps in through the air valve until the mixture becomes explosive, and the tiny flame remaining on the burner thereupon "fires back."

A substance is called *inflammable* when it can be ignited in the air under ordinary circumstances. But what would you say if you were told that air itself is inflammable under certain conditions? All you have to do is to reverse the process of a gas stove. If instead of having gas in the pipes and air outside, you had air in the pipes and gas outside, you could light the stove and cook with it just the same, for the combination of gas and oxygen would be equally effective. If men lived in an atmosphere of coal gas, we would be paying to have air piped into our homes for our cooking. Thus, when we say that some things will burn and others will not, we must remember that such a statement always means "in ordinary air."

The history of fire is the history of progress. As men have learned gradually how to tame the "red monster" and make it their servant, they have been able to develop the great forces of nature (*see Civilization*). Fire has yielded them the power of steam; it has extracted the metals from the rocks, the rubber from the gum of a tree, made hard brick from soft clay. Every factory chimney is a monument to the importance of fire. Every instrument we use, almost everything we eat, all our conveniences, even our ice, owe their existence to fire.

Legends and Worship of Fire

From earliest times there have been many legends about the origin of fire. Tribal legends of the North American Indians say various animals showed the Indians' ancestors how to make fire. The buffalo struck sparks from stones with its hoofs. The panther scratched the rocky hillsides with its sharp claws. Other early peoples said that fire came down from heaven in magic ways. For example, in an old myth we learn that Prometheus stole fire from the sun and carried it to the earth (*see Prometheus*).

There is much evidence that primitive people used fire for some time before they learned how to kindle it. When they captured fire, they tended it carefully so that it would not go out.

Gradually, the legends of the magic origin of fire and the tending of perpetual fires were associated with religious practices. Fire worship was often associated with sun worship. Fire was said to be the earthly representative of the sun-god (*see Egypt, Ancient*). Sacred fires were preserved in temples by the Egyptians, Greeks, and Romans. Priests or special people watched the fires. Among the most famous were the Vestal Virgins in the Temple of Vesta in Rome (*see Vesta*). The Mayas and Aztecs kept sacred fires burning on top of high pyramids or "fire altars."

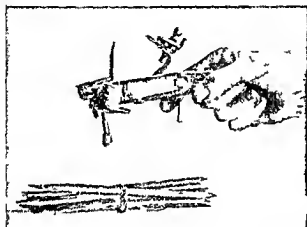
SOME OLD WAYS OF MAKING FIRE



TWO STONES STRUCK TOGETHER



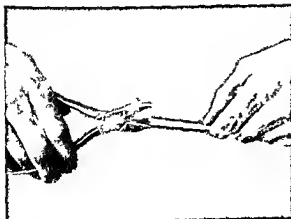
FLINT AND STEEL



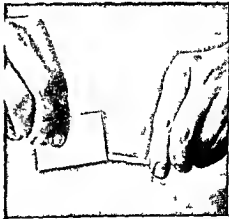
FIRE PISTOL



EARLY DIPPING MATCH



PROMETHEAN MATCH



LUCIFER, OR "FRICTION LIGHT"

In early days new fire was obtained by striking stones together. Flint and steel struck into a tinderbox containing charred linen was a great improvement. The fire pistol was a development of this method. The first chemical matches

took fire after being dipped in acid. Promethean matches were safer as the acid was contained in a small glass vial. The lucifer, invented in 1827, was the first real friction match; to light it the user drew its head through folded sandpaper.

From HAND CANNON to AUTOMATIC RIFLES

FIREARMS. Since the beginning of the second World War weapons of almost unbelievable destructiveness have been developed—atomic bombs and shells, rockets, guided missiles, and flame-throwing tanks. Yet the fighting in the war showed that the basic weapon of ground combat was still the foot soldier's hand-operated firearm. This principle was affirmed again in the Korean conflict that began in 1950.

Firearms have played a vital role in combat since the 1300's. Along with their military usage, firearms have been the standard hunting weapon for 400 years. More recently they have been carried by police and other civil authorities.

Firearms Become Shoulder Weapons

The first hand gun was a rough metal tube closed at one end and fastened to a stick. It was loaded through the open end, the muzzle, with crude gunpowder and hits of stone or metal (*see* Gunpowder). One man held the gun by the stick while another applied a smoldering fuse or "match" to a touchhole near the breech. The gunpowder in the tube exploded, generating gases which propelled the shot out of the tube. The gun was woefully inaccurate and the shot carried only a few hundred feet. Hand cannon of this type was used at the battle of Crécy in 1346 and by the Germans in 1331. (*See also* Artillery; Explosives).

During the 1400's two improvements were added. The gun was given a curved stock with a butt to be placed against the shoulder. It was now called a *hackbut*, or *arquebus*. The gun was also equipped with a hammerlike device to move the "match" to a pan of priming powder near the touchhole. The ignited powder then "flashed" through the touchhole firing the powder charge (and thus the missile) in the barrel. This device gave rise to the name *matchlock*, a clumsy arm useless in rainy or windy weather.

During the early 1500's the Huguenots developed a long-barreled matchlock that could fire a two-ounce ball up to 300 yards. This weapon was called a *musket*, a term used to describe all firearms up to the



From a hill position in Korea this American infantryman fires his Browning Automatic Rifle at the enemy. Accurate up to 600 yards, the BAR can fire at a rate of more than 500 rounds a minute.

time of the rifle. The early musketeers poured powder down the muzzle and then forced in the lead ball with a ramrod. Heavy muskets were fired while resting on forked sticks or rods stuck in the ground.

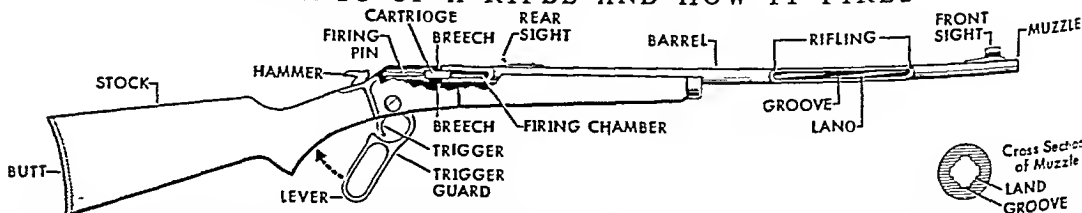
The *wheel lock* was the next step in the development of firearms. It consisted of a toothed wheel which was wound up by a key against the tension of a spring. A pull of the trigger released the wheel, and the teeth revolved against a piece of flint or pyrite. This action showered sparks into the priming pan which then ignited the powder in the barrel. Wheel lock pistols were common cavalry weapons, but muskets of this type were too expensive for military use.

Muskets for Hunting and for Warfare

Early in the 1600's the *flintlock* was invented. Its hammer, operated by a spring, held a piece of flint. When the hammer fell, the flint struck a steel cover on the priming pan, thereby opening the pan and allowing sparks to fall into the powder below. The flintlock musket was the constant companion of American colonists, used to supply game and ward off Indians. It was the weapon of the minutemen at Lexington, Concord, and Bunker Hill.

In 1807 a Scotch clergyman, Alexander Forsyth, first patented the use of fulminates for firearms.

THE PARTS OF A RIFLE AND HOW IT FIRES

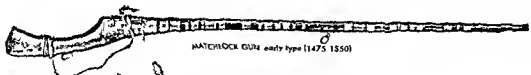


The single-shot, lever-action rifle is one of the simplest types of modern firearms. Multiple-shot rifles, pistols, and shotguns have more complex mechanisms based on the same essential parts—barrel, chamber, breech, and a firing device. In this rifle the hand-operated trigger guard opens and closes the breech for loading and unloading. The rifle is fired by squeezing the trigger. This action releases the spring-driven hammer which drives the firing pin against the cartridge, firing the bullet.

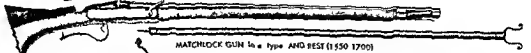
GROWTH OF THE FIREARMS' FAMILY TREE



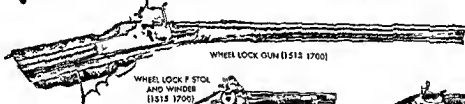
HAND CANNON (1326 1500)



MATCHLOCK GUN early type (1475 1550)



MATCHLOCK GUN in a type AND REST (1550 1700)



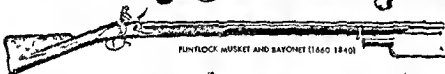
WHEEL LOCK GUN (1515 1700)



WHEEL LOCK P STOL
AND RIFLE
(1515 1700)



MIQUELET LOCK P STOL
(1600 1800)



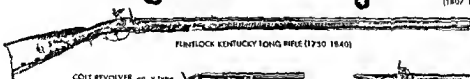
FLINTLOCK MUSKET AND BAYONET (1660 1840)



FLINTLOCK P STOL
(1660 1840)



FORSYTH PISTOL
(1807 1821)



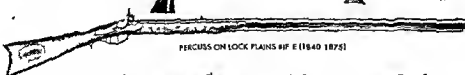
FLINTLOCK KENTUCKY LONG RIFLE (1730 1840)



COLT REVOLVER on y type
(1836 1842)



PERCUSSION LOCK P STOL
(1820 1850)



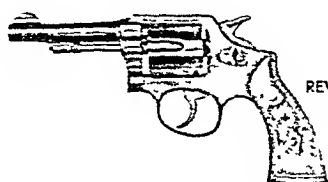
PERCUSSION LOCK PLAINS RIF E (1840 1875)



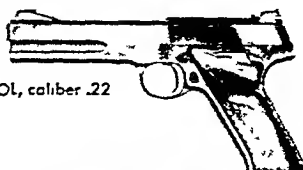
WINCHESTER MODEL 73 R FLE (1873 1924)

After the invention of the hand cannon great changes have taken place in firearms. The matchlock introduced firearms as older weapons and provided a trigger for firing. After the slight improvement of the wheellock the flintlock made firearms truly military and hunting weapons. During the flintlock era riding and bayonets were added. The percussion on lock ought cap and ball loading which was followed by metal cartridge breech loading in the repeating Winchester 73 (Photographs courtesy of Winchester)

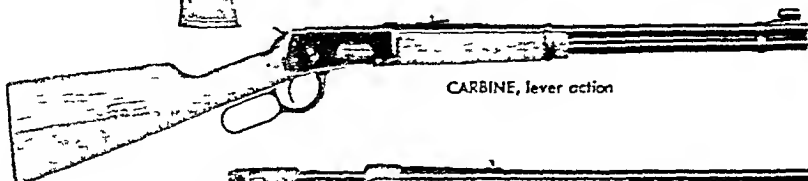
FIREARMS FOR HUNTING AND FOR TARGET SHOOTING



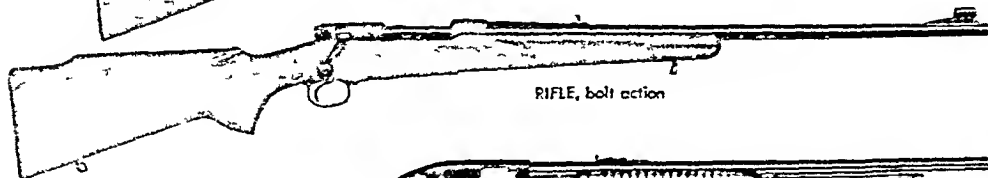
REVOLVER, caliber .38



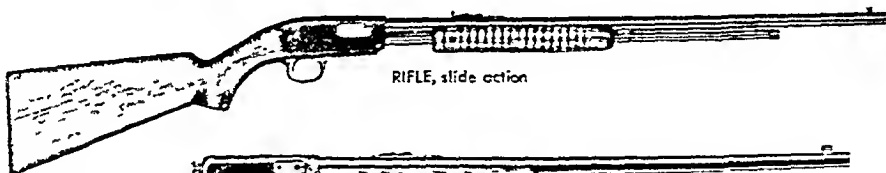
PISTOL, caliber .22



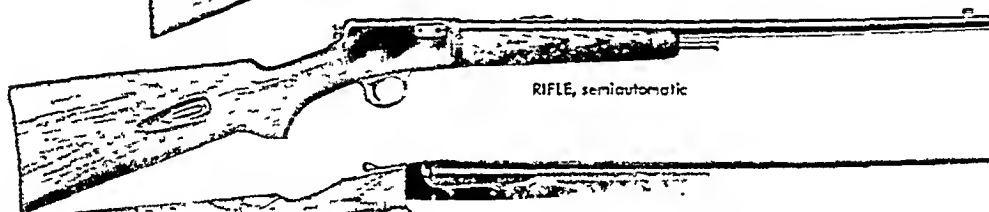
CARBINE, lever action



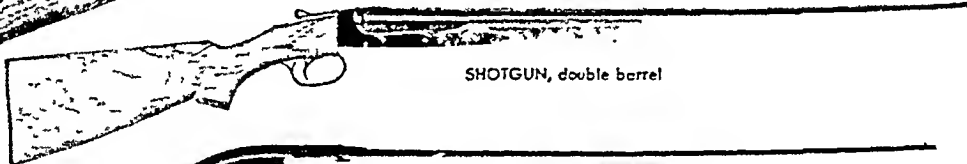
RIFLE, bolt action



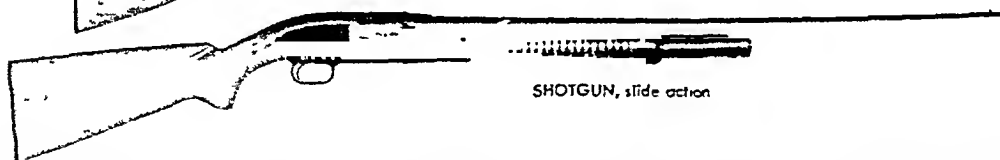
RIFLE, slide action



RIFLE, semiautomatic



SHOTGUN, double barrel



SHOTGUN, slide action

Two popular side arms are the Smith and Wesson revolver and the Colt automatic pistol. The carbine is a leading deer rifle and saddle gun. Bolt-action rifles and slide-action rifles are used for all types of hunting. The semiautomatic rifle fires ten .22-caliber bullets as fast as the trigger can be pulled. The double-barreled shotgun is the world's leading firearm for all feathered game. The slide-action shotgun is popular with trapshooters. (Photographs courtesy of Winchester.)

(Fulminates are chemicals which explode when struck a sharp blow.) This led to the development of the *percussion lock* gun. A nipple was set upright in the breech and on this was placed a small copper cap of fulminate. The hammer struck the cap and exploded the fulminate, sending a jet of flame into the powder chamber. These *cap-and-ball* guns were the chief infantry weapons in the American Civil War.

The Frontiersman's Deadly Rifle

The old musket had two major defects. To get weight and striking force, the round bullets had to be large, thus air resistance slowed them quickly. The bullets curved like pitched baseballs and thus were inaccurate beyond a hundred yards.

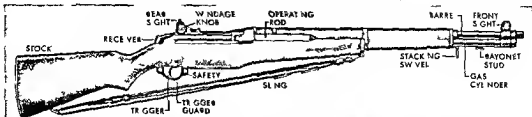
To overcome these defects the principle of *rifling* was adopted. This consisted of cutting the inside of

the barrel to provide spiral grooves and ridges (lands) to grip the bullet and give it a corkscrew spin as it left the muzzle. Rifling ended the erratic flight of balls and eventually permitted the use of long cone-shaped bullets which had reduced air resistance.

During the 1700's gunsmiths in Lancaster County, Pa., turned out a long, small-bored rifle widely used by Daniel Boone and other backwoodsmen. During the Revolutionary War, British troops learned to their sorrow of the long range and deadly accuracy of this so-called Kentucky rifle.

The American rifle was loaded from the muzzle with a ball wrapped in a "patch" of greased linen or buck-skin to make the ball fit the rifling more closely. Loading a round bullet was a slow process. Forcing a cone-shaped bullet past the rifling was

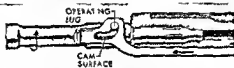
FIRING THE SEMIAUTOMATIC RIFLE



The standard rifle of the United States Army is the 30-caliber M1 or Garand. The power of the exploding gas reloads the rifle after each shot. This action gives the weapon semiautomatic fire—each trigger squeeze firing one bullet.



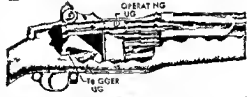
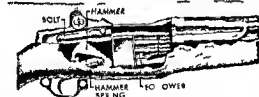
When the rifle is fired, some of the exploding gas enters the gas chamber through a small opening or gas port in the barrel. The gas blasts back the piston end of the operating rod and thus compresses the operating rod spring.



As the operating rod starts to the rear it finds the bolt locked in firing position (left). When the operating rod has moved $\frac{1}{2}$ of an inch a cam surface engages the operating lug of the bolt, turning the bolt upward and unlocking it (right).



The operating rod now carries the bolt to the rear. As the bolt moves, the extractor pulls the empty case from the firing chamber (left). When the case is clear of the chamber, a spring-driven ejector throws it free (right).



Meanwhile the bolt has forced down the hammer, cocking the rifle, and the follower has pushed up a fresh cartridge (left). The compressed operating rod spring now recoils, carrying forward the rod and bolt. The bolt reloads the chamber and then is locked in a firing position by the operating rod. (The position of the rod is indicated by the operating lug.)

even more difficult until the invention of the famous Minié ball adopted in Europe about 1852. This conical bullet was hollow at the base and fitted loosely in the barrel at loading. When fired the hollow base expanded, forcing the base of the bullet tight against the rifling.

Loading from the Breech

It was not until the breech loading principle came into use that the rifle could match the smooth bore in speed of operation. In 1810 John H. Hall, an American, had invented a breech loading flintlock rifle. It had a hinged chamber at the breech which tilted upward to receive powder and ball and then dropped

down in line with the barrel. In this model much of the propelling gases escaped from the loosely fitted breech and thus reduced the force of the bullet. The same defect crippled the power of the revolving cylinder rifle invented in 1836 by Samuel Colt, the father of the modern revolver.

During the middle 1800s many military breech loaders used paper cartridges, each one containing both powder and bullet. The soldier tore off a corner of the paper (usually with his teeth) to expose the powder to the fire from the percussion cap. The Prussian needle gun was among the earliest military types of cartridge-firing breech loaders.

The later adoption of copper and brass cartridge shells stopped virtually all gas leakage at the breech, for the shell expanded on explosion, tightly sealing the opening. The United States Army Springfield (model 1865) was produced by altering the cap-and-ball model to a breech-loading cartridge rifle. The "Old Reliable" Sharps buffalo gun, the Remington, and the Winchester 73 (the "gun that won the West") were among the most famous of the early sporting rifles using this principle.

The breech mechanism of cartridge guns was soon equipped with an ejector which cast out the empty case. It was a simple step to add a magazine of several cartridges with a device for thrusting a fresh cartridge into the firing chamber as soon as an empty case was ejected. This development produced several types of multiple-shot (repeating) rifles, some with tube magazines running through the stock (like the Spencer rifle) or fastened beneath the barrel (like the early lever-action Winchester). Others had box magazines in which the cartridges lay one above the other in the breech. This device combined with bolt action prevailed in many military rifles. One model was the 1903 Springfield .30-caliber repeating rifle long used by the Army. (Caliber, or bore size, is the diameter of the inside of the barrel expressed in inches. Thus .30 caliber means 30/100 of an inch.)

Modern Developments in Firearms

During the first World War the Army developed the rapid-firing Browning Automatic Rifle (BAR). In this weapon the back pressure from the propelling gases was used to eject the empty cartridge, to reload from a 20-cartridge magazine, and to fire. This action continued as long as the soldier kept the trigger pulled. (See also Machine Gun.)

In 1938 the Army began equipping troops with the M1 semiautomatic rifle, or Garand, named after its inventor, John C. Garand. This weapon reloads automatically from a clip of eight cartridges, but the soldier must pull the trigger for each shot. A smaller Garand, the .30-caliber carbine, was made in two models—semiautomatic (M1) and automatic (M2). In 1952 the Army announced the manufacture of a new, lightweight automatic rifle that was scheduled to replace the Garand.

Two new shoulder weapons were introduced during the second World War. One was the hand-operated rocket launcher, or *bazooka*; the other was the recoilless rifle (see Army; Artillery).

History of Pistols and Revolvers

The early pistol was simply a weapon small enough to be fired with one hand. From the huge "horse pistols," nearly two feet long, to the tiny vest-pocket "derringer" type they passed through the same stages as their larger relatives—matchlock, wheel lock (and Miquelet lock), flintlock, cap-and-ball (including the Forsyth), and cartridge. Many were double barreled. The "pepper pot" of Civil War days had from four to eight barrels arranged in a circle. The highest development of these early side arms was achieved in duelling pistols. These were often richly adorned

with silver, gold, and jewels and were made with watchlike precision.

The first great change in pistol making came with the invention of the revolver. The principle was that of a revolving cylinder containing six charges of powder and ball which could be fired in rotation through the same barrel. The Colt revolver of the cap-and-ball type used during the Civil War was replaced in 1873 by the cartridge-firing .45-caliber Peacemaker and the .44-caliber Frontier. These six shooters won fame as the weapons of plainsmen and mountain men in the early West.

The early revolver was single action; that is, the hammer had to be cocked (placed in firing position) by hand. Later models were *double action*, or self-cocking. In these revolvers, a single pull on the trigger cocked, then released, the hammer and rotated the cylinder. For military use, the self-loading, or automatic, pistol has replaced the revolver. This side arm can fire seven or more rapid shots, the cartridges feeding into the chamber from a magazine.

Shotguns, Ancient and Modern

As early as the 1500's some muskets may have been made especially for shooting at flying birds. Blunderbusses with bell-mouthed barrels loaded with small shot or bits of metal and stone were used as scatter guns for close-range shooting. Out of these weapons grew the modern shotgun, which developed much like the musket and rifle.

Modern shotguns have barrels of the following sizes: 10-, 12-, 16-, 20-, and 28-gauge and .410 (.410 inch in diameter) bore. *Gauge* is a system of measurement which has come down from the days of the musket. It is determined from the number of round balls of bore size that can be cast from a pound of lead. Thus a 12-gauge shotgun has a barrel the size of a leaden ball of such diameter that 12 of them would weigh a pound (each weighs $1\frac{1}{4}$ ounces). In inches, the bore size of a 12-gauge gun is .730.

Shotgun cartridges are made with a brass base and a paper tube. They may be loaded with any size shot from Number 12 (.05 inches in diameter, 2,385 pellets to the ounce) to Number 00 (.33 inches in diameter, 130 pellets to the pound).

Chokeboring makes the barrel slightly narrower at the muzzle. It causes the shot to fly in a closer group or pattern thus increasing long range effectiveness. A double-barrel shotgun is often made with one open barrel and one *choked*. Many modern shotguns, including single-barreled, slide-action, and repeating (or semiautomatic) arms, have adjustable choke devices. The average working range of shotguns is from 15 to 40 yards, depending on the gauge, type of shot, and the amount and type of powder used.

Firearms for Hunting and for Target Shooting

Since the days of the first colonists Americans have owned and kept firearms. This custom is protected by the second amendment to the Constitution which provides that "the right of the people to keep and bear Arms, shall not be infringed." In pioneer days firearms were needed for defense and to obtain food.

Today about 18 million Americans own firearms used for recreational shooting.

More than 5 000 gun clubs are affiliated with the National Rifle Association of America at Washington D C Many members take part in national rifle and pistol target shooting championships held annually at Camp Perry Ohio Hundreds of communities have trapshooting and skeet clubs Trapshooting is firing

a shotgun at targets (called clay pigeons) sprung into the air by a rotating trap Annual championships are conducted by the Amateur Trapshooting Association at Vandana Ohio In skeet a form of trapshooting contestants fire at clay pigeons sprung from angles which imitate field shooting of game birds It is governed by the National Skeet Shooting Association of Dallas Tex

FIGHTING *the Dreaded Enemy*—FIRE!

FIRE DEPARTMENT There are no braver men anywhere than the men who serve in your fire department Every one of them would risk his life to save yours Because almost every fire starts through carelessness they face danger in fighting fires that could have been prevented by a little care on your part If you took care you could help to save them from danger

This article tells about the perilous work of city and rural firemen For the hazards and damage of forest fires see Forests

Ever since people began to live together men have helped their neighbors fight fires Everyone had to help for one house ablaze could set the whole community on fire At first the only weapons were buckets of water and the men were organized into teams called bucket brigades Today paid firemen have replaced the bucket brigade In smaller towns neighbors still work together in volunteer fire departments

In crowded cities danger from fire is even greater Volunteers cannot gather fast enough to fight fire effectively so cities and larger towns have organized fire departments with firemen on duty at station houses day and night At the sound of the alarm they leap into their trucks and usually they reach the fire before it has had a chance to spread and cause much damage Today firemen arrive in time to put out most fires with a five-gallon can of water

Answering a Typical Alarm

At the fire station a fireman on duty stands before the alarm board equipped with a loud speaker telephones and a telegraph ticker tape Suddenly the loud speaker roars the report of a fire and its location The fireman presses a button and a gong clangs loudly He writes the address in large letters on a blackboard The men jump to their places on

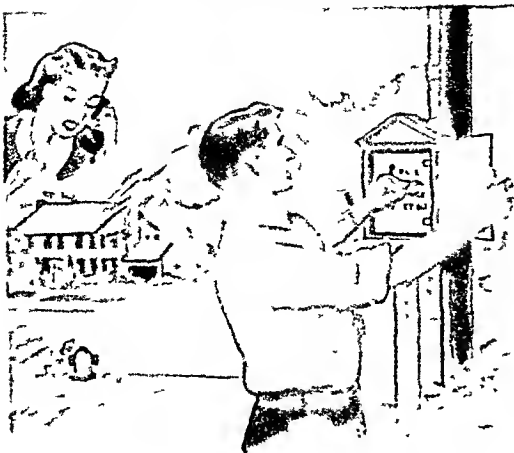


This fire truck was started because of accident or carelessness. Before it is brought under control firemen will risk their lives and thousands of dollars of property will be destroyed. It may even spread to adjoining buildings.

the hook and ladder truck and the pumper truck. With screaming sirens the trucks are away less than half a minute after the first clang of the gong.

When the pumper reaches the scene of the fire the firemen see a little smoke coming out of the basement window. Two firemen leap to the curb and run toward the building. Each carries a five-gallon can of water equipped with a small hose and a hand pump. The other firemen drag out hose lines and race to connect them to nearby fire hydrants. The hook and

HOW THE FIRE DEPARTMENT ANSWERS YOUR ALARM



Fire! Send the Alarm

To report a fire, call by telephone or from the nearest firebox. Everyone should know exactly where the firebox nearest his home is.

Receiving the Alarm

The watcher receives the alarm. He rings a gong to call the other firemen and writes the address in large letters on a blackboard.

The Firemen Leap to Action

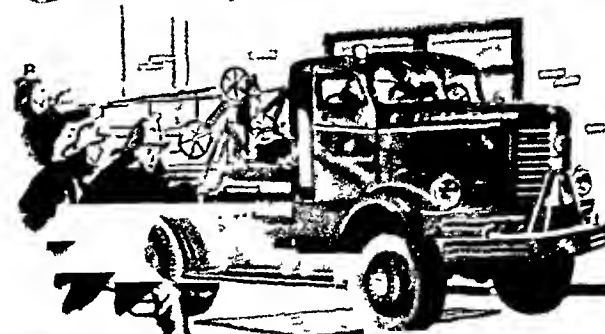
The firemen swiftly put on boots, rubber coats, and helmets. Men in bed rise, dress, and slide down the brass pole.

They Get Ready to Roll

The driver runs to the truck and starts the motor. The captain leaps beside him. He repeats the address. The firemen jump to their places.

The Fire Truck Is on Its Way

The fire truck roars out into the street, its siren screaming. It has taken only 18 seconds from the first alarm to reach the street.



ladder trucks stand by to go into action if they are needed.

The two men carrying cans enter the basement and find a litter of rags and paper on fire. They pump water on the blaze and soon nothing remains but dwindling smoke. After wetting down the litter thoroughly the firemen depart.

Firemen do not know how dangerous a fire will be until they reach it. Every minute counts in getting a fire under control, so several trucks answer every alarm. In addition to the hook and ladder and pumper trucks, a squad (emergency) truck and a battalion chief's car answer the alarm. An insurance patrol truck also goes to most fires. It is sent by fire insurance companies to save furniture and other insured goods.

The battalion chief judges the seriousness of a fire. If more equipment is needed, he will send another alarm from the nearest firebox. Fire departments use a standard system of alarms.

How the Fire Alarm Systems Work

All big cities have a central alarm office. This office receives both telephone and firebox alarms. From the central alarm office the alarm is sent to firehouses nearest the fire.

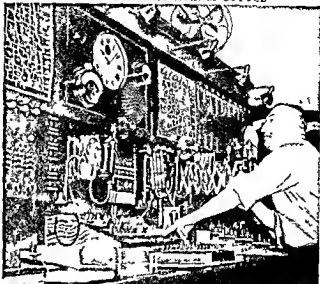
The central alarm office has three different electrical systems for sending alarms to firehouses. If one should fail, there are two others over which the alarm can be given. The one most often used is a direct wire to loud speakers in every firehouse. For the small fire just described, the voice of the fireman at the central alarm office came over the loud speaker like this: *Fire in basement at 25 Bank Street.*

Fire in basement at 25 Bank Street. The watcher at the board of the hook and ladder and pumper firehouse picked up a phone and repeated the statement and the firehouse number back to the central office. This informed the fireman at the central alarm office that the alarm had been heard. When the fire trucks left the firehouse, the man at the board again used the phone to report the equipment on its way.

Another system is a direct telephone wire between the firehouses and the central alarm office. The third system is the ticker tape machine. This is a telegraph that prints marks on a narrow width of paper as it unwinds from a spool. An alarm sent from firebox 253 would look like this on the ticker tape:

If a battalion chief pulls a second alarm for the same fire, the blaze is called a "2-11" alarm. On

AT THE CENTRAL ALARM OFFICE



When you report a fire, your call is received by men in the central alarm office. This office speeds the call to the firehouses nearest the fire by red telegraph ticker tape system, or direct telephone wire.

the ticker tape, the 2-11 alarm looks like this:

(the 2 stands for the number of alarms and 11 is an arbitrary symbol used because 11 continuous marks are used for no other purpose). If the fire equipment sent in answer to the 2-11 alarm is not enough to put out the fire, the firebox will be pulled again. Thus 3-11, 4-11 and 5-11 mean a third alarm, a fourth alarm and a fifth alarm for the same fire. If more than five alarms are sent, the extras are called special alarms.

The fire described came over the telephone to the central alarm office. By questioning the caller, the fireman learned that it was a small basement fire. So the equipment described—more than enough to put out the fire—was sent. If the area of a fire is not known—as when an alarm comes through a firebox—the central alarm office would send this equipment:

- 5 pumper trucks
- 2 hook and ladder trucks
- 1 squad truck
- 1 water tower
- 1 high pressure wagon
- 2 battalion chiefs' cars

The amount and kinds of equipment sent vary to some extent from city to city. They also vary from district to district within a city, depending upon the height of buildings and other factors. A 2-11 alarm sends another such group of equipment and, in addition, an ambulance and a division fire marshal. Each added alarm sends the same amount of equipment.

IN CASE OF FIRE

- 1 Warn the members of your family
- 2 Call the fire department by phone or the nearest fire-alarm box
- 3 Stand at the curb so you can tell the firemen exactly where the fire is
- 4 Do not open a door that feels warm
- 5 If there is dense smoke, get on your hands and knees and crawl—the air is purer near the floor
- 6 If your clothing catches fire, roll up in a heavy blanket or rug
- 7 If smoke and fire cuts you off from the stairs, tie clothing or bedclothes together to make a rope

Jump only if you have to!

When a big fire strikes one area of a city, the firehouses in the vicinity are emptied of equipment. To insure protection against more fires in this area, some of the equipment from other parts of the city moves into the empty firehouses. Cities and their suburbs and groups of smaller towns cooperate in this way.

Old and New Equipment

The *bucket brigade* was the first organized effort to fight fire. It was used in ancient times, and it was the only means of fighting fire that men had until the 18th century. It is still used today in sparsely populated areas that have no other fire-fighting equipment. In such places as army and Boy Scout camps, water-filled buckets are kept handy to guard against the outbreak of fire.

The first effective fire-fighting equipment was the *hand pump*. The hand pump was mounted on wheels, and running firemen pulled it to the fire. At the fire they dropped the pump's suction hose into a near-by pond, well, lake, or river, and laid a hose from the pump to the fire. Men pushed and pulled on the pump's handbars to force water through the hose. The hand pump is still used in some very small communities.

The next great advance in fire-fighting equipment came about 1850. A steam engine was put on wheels to make a *steam pumper*. Running firemen still pulled the pump to fires by hand. But soon horses were harnessed to the steam pumper, and the firemen rode to the fire on the pumper. Horses got the pump to the fire more quickly, and the firemen arrived fresh and ready to put out the fire. The biggest steam pumpers could throw 750 gallons of water a minute. The Chicago Fire Department had one in service as late as 1923.

The first gasoline-motor fire engine went into operation in 1910. It was not a pumper, but before long men learned how to harness the power of the gasoline motor to the pump. Today almost all fire engines are gasoline-propelled and operated.

ESCAPING FIRE PERILS



A policeman carries a small child to safety after firemen have rescued her from a flaming bedroom.

Modern pumpers can throw from 500 to 1,650 gallons of water a minute, depending on pump and motor capacity. Large cities need these pumps because water pressure in the mains is low. The pressures vary from 18 to 31 pounds to the square inch. This pushes only a weak water stream through the hose. The motor of the pumper increases this pressure to more than 150 pounds to the square inch. A hose stream at this pressure directed against a brick wall can knock it down. Two or more firemen are needed to hold and aim the hose nozzle. Large cities also install high-pressure water mains in the areas most vulnerable to fire. Usually the entire water system of most small cities is kept under high pressure.

The *hook and ladder*, or *aerial*, truck can extend its steel ladders as much as 100 feet into the air. The ladders are extended and placed into position by the power of the truck motor. Hose lines run up to nozzles at the ladder top. These nozzles can be aimed mechanically by one fireman.

The *water-tower truck* has a steel tower that rises 65 feet in the air. Nozzles on top of this tower can throw water eight stories high. The *high-pressure truck* goes with the water tower on alarms; it carries the hose used by the water tower. Large cities have many water towers still in use, but they are being replaced by the more efficient aerial trucks.

The *light wagon* is a truck sent to all big night fires. It has six



A man caught on an upper story lands safely in a rescue net. Nets are used when other paths to safety are cut off by flames.

big floodlights and extension lights that can be carried inside where the firemen are fighting the fire. The light wagon's motor generates the electricity used in the lights.

The *squad truck* is an emergency vehicle. It carries many special tools. These include a great jack powerful enough to lift a street car from the body of a person trapped underneath and acetylene torches that can cut through jammed steel doors. Squad trucks are called in all kinds of emergency if someone faints on the street if a ditch digger is covered by earth in a cave-in if a cat is marooned in a tree if a small child is locked in a bathroom and for many other emergencies.

Fire department *ambulances* have stretchers, splints and various first-aid need. Both the *squad truck* and the *ambulance* carry *respirators*. These devices force oxygen into the lungs of firemen and fire victims overcome by smoke or of persons whose breathing has stopped for other reasons. Both the *squad truck* and the *ambulance* are called in many cases of emergency that do not arise from fire.

Special fire-fighting equipment includes *chemical trucks*. These trucks carry tanks full of a form of carbolic gas or similar chemicals. The chemicals are used to put out gasoline and oil fires and fires in electrical equipment. Firemen spray the chemical on the fire through a hose. It forms a thick foam over the burning material and cuts off oxygen needed for burning.

Firemen use various special purpose nozzles. One of these is the *fog nozzle*. This breaks up water into billions of tiny droplets. The droplets however are more truly a water vapor than a fog. Firemen can use this fog on fires in electrical equipment with out danger of being electrocuted.

Firemen and Their Jobs

Most fire companies have 16 men. Seven of these men are on duty at a time usually for a 24-hour shift. A second seven man group then comes on duty for another 24 hours. The two extra men take the places of the firemen who have time off.

A *captain* commands a company. He has general authority over both shifts and takes direct command of one. His *lieutenant* commands the other shift. A *battalion chief* commands several companies. Over him is a *division marshal*. A *fire marshal* commands several divisions. The head of a big city fire department is called *chief marshal* or *commissioner*.

Some firemen are specialists. One of these is the *tiller man* on a hook and ladder truck. The hook and ladder truck is so long that to turn corners it is necessary to steer both front and rear wheels. The *tiller man* steers

FIGHTING FIRES INSIDE BUILDINGS



Masked firemen enter a fire swept hall filled with smoke and gases. The masks cost a fortune and their manufacture purify air for breathing.



Rescuing firemen gently lower a fire victim in a wire stretcher over a heap of black smoke scorched timbers and plaster.

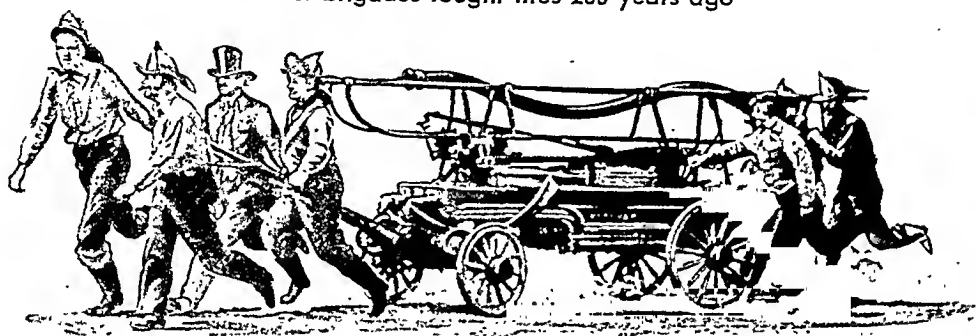


Two members of an inhalator squad revive a fireman overcome by smoke. The inhalator forces in oxygen into a respiratory system.

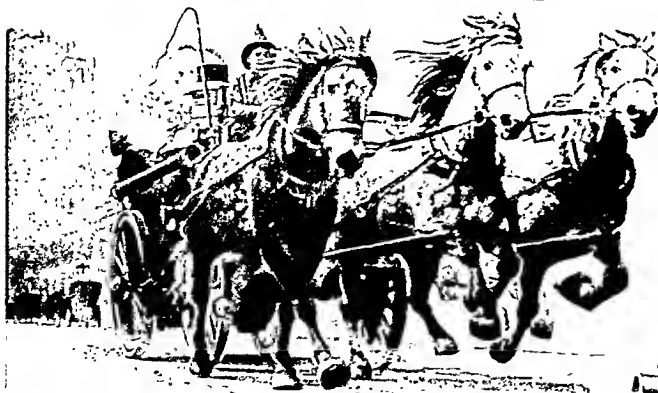
OLD WAYS TO FIGHT FIRE



1. Bucket brigades fought fires 200 years ago



2. This hand pump was used about 100 years ago



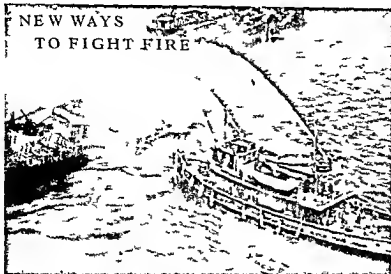
3. After 1850, steam fire engines were used

4. This was the first gasoline-engine truck. It was used in 1910

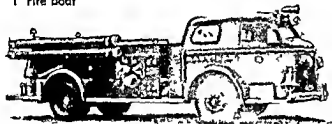


In early days the law required householders to bring buckets to a fire. Later a hand pump was put on wheels. A big advance in fire fighting came when men put a steam engine on wheels to operate a pump. An even greater improvement was the gasoline engine. It powered the truck itself and drove the pump faster than the steam engine could. Another great aid is the modern underground water-supply system, with fire hydrants ready for attaching the hose.

NEW WAYS TO FIGHT FIRE



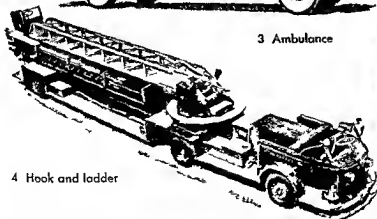
1 Fire boat



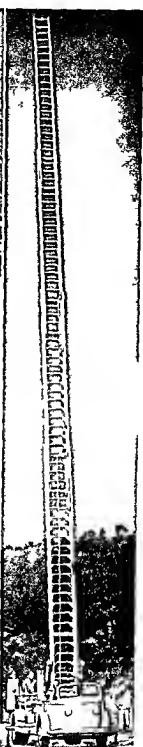
2 Pumper



3 Ambulance



4 Hook and ladder



The fire boat fights waterfront fires and sends water through hoses to fight blazes two or three blocks inland. This boat can throw 14 000 gallons of water a minute on a blaze. The modern pumper truck throws 1 650 gallons a minute. Fire department ambulances answer emergency as well as fire calls. Hook and ladder trucks can raise their ladders 100 feet into the air.

FIGHTING A FARM FIRE



Country roads do not have water hydrants. Fire fighters must get water from wells, a pond, or a river. Here they are at work on a barn fire. Some rural fire companies have tank trucks that carry water. They may bring as much as 2 000 gallons to the fire.

the rear wheels. Other specialists are the radio and electrical mechanics who keep the alarm systems operating. The firemen who work in the central alarm office are also specialists. They are trained to get information from the excited people who report fires. They must have a good knowledge of city streets so that no time is lost in dispatching fire equipment to a fire.

The long hours firemen spend on duty while they wait for an alarm give them much time for hobbies and special community services. Usually one of the firemen on a shift is a good cook; his brother firemen persuade him to do most of the cooking in the firehouse kitchen. Firemen use their on-duty free time in many ways. Some study to secure advancement in the fire department, others read, and many engage in such hobbies as model building, beadwork, woodwork, and leatherwork. Firemen give much of their free time to fixing worn and broken toys. These are given to needy children at Christmas time.

Fighting Fire in Small Towns and in the Country

Most cities with populations of 10,000 or more have full-time firemen. The fire departments of these towns differ little from those of the big cities, except in size. Because most towns and small cities have high-pressure water mains, the pumper truck is not needed. The height of the buildings of a small city will determine the ladder extension heights of its hook and ladder trucks. Few small cities have aerial ladders that reach as high as 100 feet. Nor is it likely that a town of less than 50,000 has fire department am-

bulances and squad trucks.

Very small towns and rural areas may have only one fire truck. This carries equipment designed to put out fires of the type that occurs most often in that area. A typical village fire truck has short ladders, ropes, salvage covers, a stretcher, a steel cable and grappling hook for hay fires, a tank of water, hose, and axes. Fire engines with special qualifications are built for fire departments in areas that do

not have water systems. One of these is a truck with a large tank on it that holds 2,000 gallons of water. Another is a pumper like those of the big cities. These pumpers suck up water from wells, ponds, creeks, rivers, or lakes, and pump it to the fire.

Towns with populations of less than 10,000 usually have one or more full-time firemen. Other active members of the department are volunteers. They either give their services without pay or are paid a set fee for each alarm they answer.

How Firemen Are Trained

One of the very first fire department drill schools was established in New York City in 1883. The first

FIGHTING THE GASOLINE FIRE



These fire fighters are smothering an airplane fire with chemical foam. They use foam or water vapor (fog) because a swift stream of water would only spread the gasoline and make the fire worse. The firemen wear protective asbestos clothing.

schools taught firemen how to scale ladders and fight fire on the upper floors of tall buildings. The modern drill school teaches ways of fighting oil fires and fires in electric-power installations proper methods of ventilating fires salvage methods and lifesaving techniques.

It was not until the 1920's that schools were set up to train the firemen of small cities and volunteers. These drill schools have short three-to-five-day courses. The schools are sponsored by state universities volunteer firemen's associations and other organizations. Some states send experienced firemen to small communities to instruct firemen. More than 350 state and regional schools are conducted annually.

Guarding Against Fire

Every year the five boroughs of New York City which are separated by long water stretches expend about \$60,000,000 to fight fire. Chicago with many through streets connecting all parts of the city spends about \$12,000,000. From 5 to 10 per cent of this money is used for the purchase of new equipment. Ninety to 95 per cent is needed to pay the fire fighters.

Fire losses have been cut greatly by carefully planned fire prevention activities. One important activity is the work of the fire inspectors. The fire inspector visits buildings and various kinds of installations such as the storage tanks of oil companies. If he finds a fire hazard he warns the property owner to correct it. Later he makes another visit to determine whether his orders have been carried out. If they have not he brings the property owner before a court. The court usually sets a time limit for making the corrections. If the owner still has not corrected the fire danger the court levies a fine and again orders the corrections made. If the fire inspector visits a building

MATCHES ARE DANGEROUS PLAYTHINGS



Young children can burn themselves or cause a serious fire by playing with matches. Do not let them.

fire is needed—in a stove, furnace or fireplace—we can be especially cautious. But in particular we must obey the following rules:

Matches. Keep all matches out of the reach of small children. When large kitchen matches are used they should be kept in a mouse-proof container.

Rubbish. Do not let rubbish pile up. Burn it in cement or wire incinerators placed well away from wooden fences, garages or other buildings.

Cleaning fluids. Do not use inflammable cleaning fluids inside the house. Even a match lighted well away from the fluid, the pilot light of a gas stove or the static electric sparks caused by rubbing silk against silk or wool against wool can cause the fluid to flame.

Old rags. Do not throw old rags on a shelf in a closet or even in a steel cabinet. When you have finished with an old rag, burn it.

Frayed electric cords or defective electric equipment. Short circuits cause many fires. If the cord of any appliance is so worn that the insulation is frayed, do not use it. If an appli-

cance blows out fuses or must be shaken to establish a connection, have it repaired before using it.

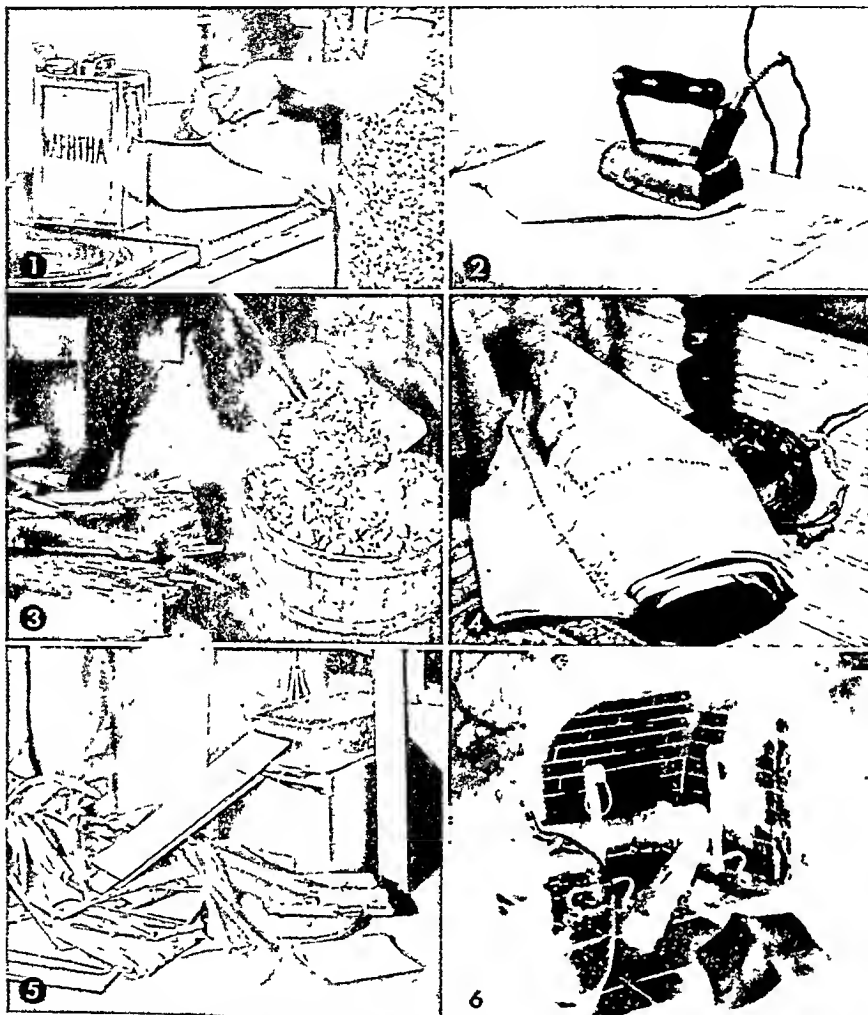
Electric fuses. If a fuse you have just inserted in the fuse box burns out, one of two things has caused

DO NOT FEED A FIRE WITH KEROSENE



Throwing kerosene oil on a fire makes it burn better and may cause a serious explosion and fire. Do not do it.

PREVENTING FIRES AT HOME



1. Do not clean clothes indoors with inflammable cleaning fluids. 2 Do not leave the room while a connected electric iron is heating. 3. Never carry hot ashes in wooden baskets or cardboard boxes. Use metal baskets or make sure there are no sparks by wetting down the ashes. 4. Worn-out lamp cords can short-circuit and cause a blaze. If

you cannot replace a worn-out cord, do not use the lamp. 5. Many fires start in litters of rags, paper, and pieces of wood carelessly thrown into closets, under stairs, and such places. Do not let litter pile up. 6. Sparks from an unscreened fireplace can set fire to rugs, furniture, wooden floors, or papers. All fireplaces should have screens.

it: either you have too heavy a load on the circuit—too many lights and appliances in use—or there is a short circuit in the line. If fuses continue to blow out after you have disconnected some of the lights or appliances, look for the short circuit or call an electric repairman. Do not use a fuse with a higher amperage than directions call for. And do not insert a coin, tin foil, or other metal in the fuse socket.

Fireplace. Open fires throw sparks. Flying sparks can set fire to rugs, paper, furniture, or a wooden floor. A fireplace screen should be in front of the fire except perhaps on such occasions as when toasting marshmallows. The screen should fit closely to the stone or brick on all sides of the fireplace. Do not let an unscreened fire go unwatched.

Ashes. Warm ashes often set fire to wooden baskets and cardboard boxes. Ashes should never be stored or carried in wooden or paper containers. If they must be, the ashes should be soaked with water. It is best to put ashes in a metal container.

Cigars, cigarettes, and pipes. People who fall asleep while smoking have caused many dangerous fires. Careless disposal of tobacco ashes or stubs has caused many more. If you see lighted cigarette or cigar stubs or smouldering pipe ashes where there is danger of fire, put them out at once.

Open flames. Curtains, towels, or other cloth should never be placed near the burners of gas or electric stoves or near an open flame or hot stove.

Kerosene lights and candles. A metal light or candle base is safer than a glass base. The bases should be wide enough so that the light or candle cannot easily be tipped over.

Furnaces, chimneys, and flues. Many fires start because flues have

rusted through. These should be replaced immediately. Soot deposits in furnaces, flues, and chimneys are another fire hazard. These should be removed regularly.

Gasoline and oil. Do not keep cans of gasoline or oil in your home, or, if it can be avoided, in garages or sheds. The safest place to store gasoline or oil is in the open air well away from buildings.

Campfires. A fire should never be left burning when you leave the campgrounds. Wet the fire and the area at least a foot around it thoroughly or dig a hole and cover the ashes and coals with three inches of damp earth.

Fire alarms. It is important when you telephone a fire alarm that you be prepared to tell the exact location of the fire. You should know where the near-

est fire-alarm box to your home is and how to operate it. After turning in a fire alarm you or some other dependable person should wait at the curb to direct the firemen to the fire. In winter home owners can assist firemen by keeping deep snow away from fire hydrants. When the fire trucks arrive the firemen are in charge. Obey their orders. Stand well back from men and equipment. Above all do not do anything foolish. Many lives have been lost in an attempt to save property.

Christmas Fire Dangers

Christmas trees quickly dry out and so they catch fire easily. When you set up a tree its stub should be cut off at an angle about an inch above its end. The stub should be suspended in a pan of water and the water should be replenished every day. The tree should not block a doorway. It should be securely fastened so it won't fall. Some people fasten the tree with fine almost invisible wires to the walls. The cords of decorative lights should be checked before using. Inflammable decorations should not be used. Candles should never be used to light the tree. A fire extinguisher should be in the room ready for use.

Some other fire hazards during the Christmas season are cotton batting used to simulate snow, paper or other inflammable room decorations, discarded wrappings from Christmas packages, Santa Claus whiskers, and inflammable clothing.

FIRE EXTINGUISHERS We use fire extinguishers to put out little fires before they grow into big ones. They hang ready to use on the walls of schools, theaters, factories, stores and office buildings. Many people carry them in automobiles. The law requires ships, railroad trains, highway buses and airplanes to have them on hand.

To understand how the extinguishers work we must know how fires start and burn. When any substance is heated to a certain temperature, called the *ignition point* for the substance, it combines with oxygen from the air and bursts into flame. Usually this fire raises the temperature of adjoining substances to the *ignition point*. Then the fire spreads.

Extinguishing methods must also take into account the type of material burning.

Procedure for Extinguishing Fires

Fires start most frequently in ordinary materials such as wood, paper, rubber, and leather. These materials usually form glowing coals which help sustain the fire. Such fires can be stopped most readily by cooling. Water is applied to reduce the temperature below the ignition point.

If an inflammable liquid such as gasoline, grease or oil takes fire the material and the fire would float and spread if only water were used. Water is useful only if applied expertly as a water fog. Such fires should be smothered by applying some covering to cut off the supply of oxygen from the air. A fire in charged electrical equipment should be quenched with some agent which does not conduct electricity. Otherwise the operator might be electrocuted. Some extinguishing

methods cut off the fuel from the flame (flame separation) as when nitro or other explosives are used to extinguish oil well fires.

Types of Fire Extinguishers

Fire extinguishers are made in several types to apply these methods according to need. The simplest type contains water and has a hand pump to throw a stream. A common chemical type is the *soda-acid* extinguisher. It contains bicarbonate of soda dissolved in water and a small amount of sulphuric acid in a separate container. When the extinguisher is turned upside down the chemicals mix and generate carbon dioxide gas (CO_2). The gas provides pressure enough to throw the watery mixture from 30 to 40 feet.

A smothering type of extinguisher for fires in inflammable liquids may be a steel cylinder filled with carbon dioxide gas. The gas may be held under a pressure as high as 2 000 pounds to the square inch. It is released through a hose and cone-shaped nozzle by operating a high-pressure trigger valve or with a valve wheel which punctures a thin metal sealing disk. The gas is heavier than air and forms a smothering blanket over the fire.

Fires can also be smothered with a foam type extinguisher. Separate compartments contain solutions of soda bicarbonate and aluminum sulphate mixed with a foam stabilizer. When the extinguisher is turned upside down the chemicals form carbon dioxide gas. The gas forms tiny tough bubbles in the liquid and forces the foamy mixture onto the fire. The foam floats on the burning liquid smothering the fire.

Dry powder extinguishers contain dry soda bicarbonate mixed with materials to prevent caking. The powdery soda is forced onto the fire by releasing a cartridge of inert gas held under high pressure. Foam and powder extinguishers provide a lasting coating over the liquid surface. The coating prevents *reflash*—that is, re-ignition of vapors from the liquid.

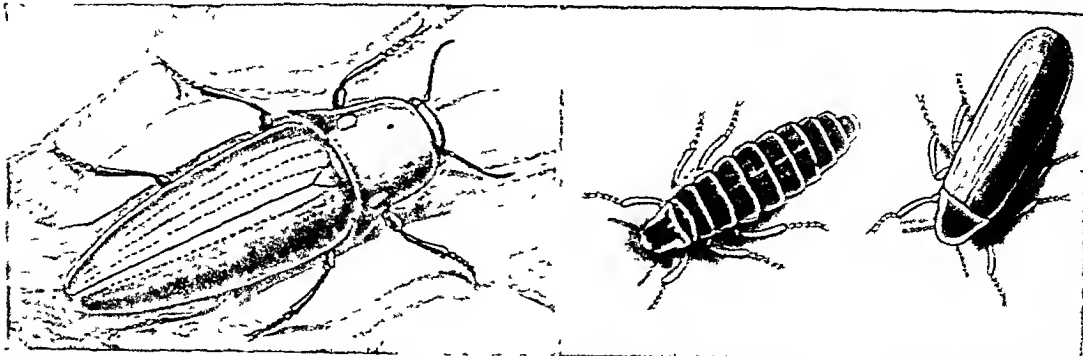
Extinguishers for fires in charged electrical equipment contain carbon dioxide gas under pressure or liquid tetrachloride. The latter type uses a hand pump to force out the liquid. The fire vaporizes the liquid and the heavy vapor smotheres the fire. The operator must not breathe the vapors and fumes which arise from the fire, as they are quite harmful.

Precautions in Using Extinguishers

Water type extinguishers must be protected against freezing by nonflammable antifreeze materials or they must be kept in heated storage cabinets. All extinguishers should be inspected regularly and recharged if necessary to ensure proper operation when need arises. Only those extinguishers which bear the approval label of a nationally recognized testing laboratory can be considered adequate and reliable.

Most approved portable extinguishers have an operating period of less than one minute. But this is enough if the extinguisher is properly used to control most fires at the start. The value depends upon the efficiency of the operator. In all cases the fire department should be called immediately to avoid delay if the extinguisher does not stop the fire.

INSECTS THAT PRODUCE LIGHT WITHOUT HEAT



With all his science, man cannot duplicate the feat of these little beetles that produce so-called "cold light"—that is, light which does not depend upon heat for its origin. The one on the left is the *cucujo* or firefly of Brazil, while the two insects at the right are European glowworms. The female is wingless and carries the light, which she uses as a signal to her flying mate.

FIREFLIES AND GLOWWORMS. Man-made lamps generate heat as well as light, and the heat represents wasted energy. Fireflies and glow worms are ahead of man in their ability to produce "cold light."

Fireflies—which are not "flies" at all, but members of the beetle order—have been objects of wonder and romantic stories in all ages. Flitting about on warm evenings, or creeping in the damp grass, these "living stars" with their pulsating light produce a weirdly beautiful effect.

Certain large and brilliant fireflies of tropical America, called "eucujos," are captured by the natives and kept in wire cages, where they are fed on sugarcane and bathed twice a day in tepid water. On festival nights they are sold to the young women of the region, who thread them together and weave them in their hair or fasten them to their ball gowns, to glow there like flaming jewels. The ancient Aztecs are said to have confined large numbers of these insects in fine-meshed baskets, which were used as lanterns on night journeys. In Japan the sport of hunting fireflies is a popular pastime. Kept in tiny cages, they ornament the home and garden, and many dealers make a business of selling them.

The glowworm, also, which is chiefly a native of Great Britain and northern Europe, is a beetle. The female is wingless and crawls about on the ground at night devouring snails and other small creatures. She alone possesses a lantern, which consists of paired masses of fatty tissue beneath the skin on the under side of the abdomen, and she uses her light to signal to her flying mate. It is of this beetle that the ghost in Hamlet speaks when he says:

The glowworm shows the matin to be near,
And 'gins to pale his uneffectual fire.

Naturalists have criticized Shakespeare for these lines, pointing out that he should have used the feminine "her" in referring to the glowworm, and that the light is by no means "uneffectual."

Among the true fireflies or "lightning bugs," as they are often called, both males and females have wings and lanterns. Besides their use as signals to

draw the sexes together in courtship, the lights are believed by some to be a warning device. Birds, bats, and other nocturnal creatures soon learn by experience that the "bug with the fireworks" is unpleasant to the taste, and thereafter they leave it alone.

The fuel in the firefly's lamp is a substance named *luciferin*, which consumes oxygen and so generates light. To speed the process, *luciferase*, a catalyst, is necessary. When luciferin is burned, it is not gone forever; instead it is changed back to its former state, and the firefly is ready to produce another flash. (See Phosphorescence.)

The fireflies found in the United States, as well as the European glowworms, are not more than half an inch long and belong to the family called *Lampyridae*. The "eucujo" of tropical America sometimes reaches two inches in length, and is a relative of the click beetles, belonging to the *Elateridae* family. Certain luminous centipedes are often mistaken for glowworms.

FIREPROOFING. When we say that a building is "fireproof" we mean that it is built of steel, stone, brick, cement, or some other non-combustible material; or more often that it is only slow burning because of slate or tile roofs and asbestos linings, or is made of wood that has been chemically treated with silicate of soda or borax or phosphate of ammonia. Wood so treated will stand terrific heat, though it will ultimately burn or char.

Cloth also can be rendered fireproof. The same Englishman who made the first coal-tar dye, Sir William H. Perkin, made many experiments in trying to make flannel resistant to flame. He succeeded so well that the heat of a match is scarcely sufficient to ignite a piece of flannel treated by his method. The process consists in dipping the cloth in a solution of different chemicals so that an insoluble compound of tin is formed, or precipitated as a chemist would say, right in the fiber of the goods. Sodium tungstate is also used instead of the tin compound.

A solution often used to make costumes and decorations fire resistant is made by mixing seven ounces of borax and three ounces of boric acid in three quarters of a gallon of warm water. (See Asbestos.)

LIGHTING UP THE SKY WITH FIREWORKS



Rising aloft like flowers of fire this magnificent display of fireworks is being set off by a group of naval vessels in a harbor. The fireworks light up the sky as well as the ships.

Fireworks can be set up to go off in set patterns that resemble recognizable objects—human faces, flags, vehicles and similar designs. The patterns can even be given the illusion of motion.

FIREWORKS Properly set off by people trained in their use, fireworks make a beautiful display against the evening sky. No Fourth of July celebration would seem complete without them, and they are used on many other festive occasions as well. The scientific name for fireworks is *pyrotechnics*, from Greek words meaning fire arts.

The propelling and exploding force in fireworks comes from a combination of saltpeter, sulfur and charcoal. The same substances, used in different relative quantities, also make up black gunpowder (see Gunpowder). Historians believe that fireworks were invented first and that black powder came as a result of experimenting with different quantities of the same substances in the mixture. Thus fireworks came before guns, and the first firearms buried flaming materials, not bulletlike projectiles.

Fireworks were manufactured in Italy as early as 1540 and by the 1600's they were widely used in England and France. Most of the varieties known today, such as display rockets, aerial bombs, pin wheels (or Catherine wheels) and fountains, were devised in this early period. For centuries the Chinese set off fireworks to celebrate their holidays and when trade between the Orient and the West expanded, China became the world leader in the manufacture of fireworks. Not until the middle of the 19th century did the custom of shooting off fireworks to celebrate Independence Day become general in the United States. Today the United States is the leading producer of fireworks.

How Fireworks Are Made

Nearly all fireworks have the same components: the *starting powder*, which first catches fire; the *bursting powder*, which causes the final explosion; and the *quick match*, which leads the spark of fire from one point to another. Resin, camphor, gun and similar

substances modify the strength of the explosion. Fire crackers explode with a loud bang because the mixture is held in a tightly closed cylinder.

The brilliant colors of fireworks come from bright-burning metallic salts. Sodium salts give a deep yellow color; calcium, red; strontium, crimson; barium, green; and copper, green and blue. Magnesium and aluminum provide an electric-white effect. Calomel, hexachlorobenzene, or other chlorine compounds are used to intensify or brighten colors.

Roman candles and other fireworks which soar into the air get their momentum from expanding gases. These are produced by the rapid burning of the saltpeter-sulfur-charcoal mixture. In leaving the end of the Roman-candle tube, the gases react (push) against the tube and so move it. Rockets, jet planes and the proposed space ships use this reaction principle (see Jet Propulsion, Rockets).

The stars in Roman candles are hollow balls made of the explosive mixture and of color imparting metallic salts. Gum and shellac help hold the shape of the balls. These are evenly distributed in the tubes and the spaces between them are filled with a slow-burning substance. Pin wheels are made by coiling long paper tubes which are tightly filled with a fast-burning mixture around a frame which can spin freely on its axis. Flowerpots use the principle of the Roman candle, but the piece itself stays on the ground.

Wide Uses for Fireworks

Fireworks serve many useful purposes. Railroad trains, trucks and cross-country buses carry *fuses* (red flares) which are placed behind stalled vehicles to avert collisions. Airplanes carry parachute flares to light up the ground area for forced landings at night. Rockets, Roman candles and blue Bengal lights were long used as signals between vessels.

at sea and from ship to shore, and rockets still are used as signals of distress. In World War I, advancing infantry detachments sent information to the artillery in the rear by rocket signals. At night "star shells" with parachutes attached to keep them aloft were fired from special guns to light up No Man's Land. In World War II, rockets projected from airplanes, ground vehicles, and ships were used by the combatants on both sides (see Rockets).

Unfortunately, fireworks cause a tremendous loss of life and property as well as injure thousands of people every year. This is particularly true of Fourth of

July observances in the United States. To eliminate these losses, many organizations interested in fire prevention and human welfare urge the adoption of state laws that forbid or limit the sale of fireworks to retail purchasers. Such laws usually permit the display of fireworks (pyrotechnics) under proper supervision.

Many cities and communities stage patriotic programs or sports events in some large central place where fireworks can be set off by trained adults as part of the program. Events of this sort permit thousands of people to see beautiful pyrotechnic displays.

FIRST AID

FIRST AID. Everyone at some time has to give first aid, if only for a nosebleed or a minor cut. In more serious situations, prompt and intelligent first aid may save a life and lessen the danger of shock or injury. It is a vital part of the Civil Defense program, which President Eisenhower called a "sheer necessity in the day of H-bombs." The Federal Civil Defense Administration urged every family to get a first aid kit and to learn first aid.

Intelligent first aid is based on two things. The first is knowing what to do; the second, knowing what *not* to do. Anyone can learn the basic points described in this article and should learn them now to be prepared, because first aid is *emergency* treatment. You cannot stop to read about it when the time comes.

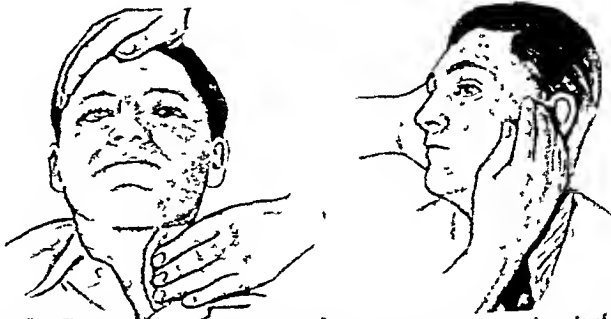
Emergency Situations

There are four general situations in which immediate aid may save life. They are heavy bleeding, severe shock, stoppage of breathing, and poisoning. Treatment in these situations is described later.

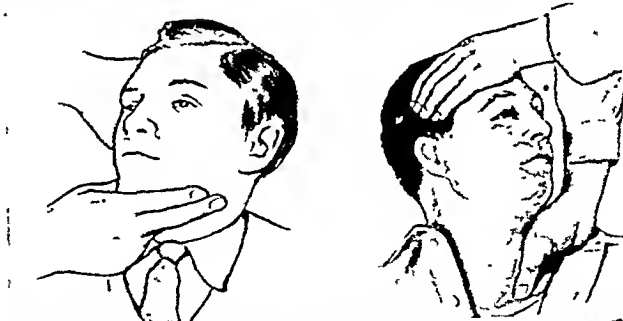
Do not move the victim of a violent accident until you know his kind of injury. If he has broken bones or if he is losing blood, you may harm him more by lifting or carrying him. If his spine (vertebrae) is damaged, clumsy handling may cause paralysis or death.

Keep the victim warm. This is the best way to check the severe effects of shock. In cold or damp weather you will have to

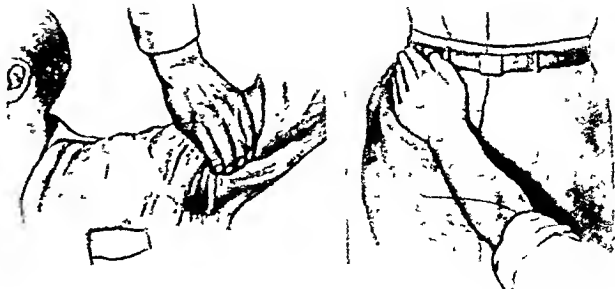
PRESSURE POINTS TO CHECK ARTERY BLEEDING



For artery wounds in the throat (left), press your fingers on the side of the windpipe, against the spine. Press your fingers just in front of the ear, against the skull, for wounds in the temple, scalp, or forehead (right).



For face wounds (left), press along the jaw. Put your fingers about an inch forward from the angle of the jaw. For wounds in shoulder or armpit (right), press the inner end of the collarbone downward against the first rib.



For arm and hand wounds (left), press inside the upper arm, halfway between the shoulder and elbow. For leg wounds (right), put your hand on the line of the groin and press against the pelvis. Always press firmly on any point.

Starting position



Pressing out air



Permitting air to enter lungs



Helping lungs take in air



REVIVING A PERSON WHO HAS STOPPED BREATHING

This is the artificial respiration method now approved by the American Red Cross. These pictures show the complete cycle. Note that in "pressing out air" and in "helping lungs take in air" the operator keeps his elbows straight. Repeat the

cycle about 12 times a minute. Keep up the artificial respiration until the victim resumes breathing by himself or until a doctor pronounces him dead. Pressure and lifting periods should take about two seconds each; release periods about one second.

risk moving him gently to get coverings under him as well as over him. If the victim is conscious speak to him confidently. Do not show him his wounds or injuries because the sight of them might increase the state of shock.

Checking Heavy Bleeding

The average body has less than five quarts of blood. The rapid loss of half this amount always causes death. Even a much smaller loss may be fatal when accompanied by the shock of an accident. The first thing to do is to discover and check heavy bleeding.

Quickly take off or cut away any clothing that hides the wound. If the blood is coming in strong jets in time with the pumping of the heart, an artery has been punctured or cut. If the flow of blood is even and steady it is probably coming from a vein.

Bleeding from an Artery

Do not take time to make a bandage. Instead immediately use finger pressure as shown in the pictures on the preceding page. There are six pressure points to control bleeding in various parts of the body. When you are pressing on the right point, the flow of blood will be checked. Press firmly and steadily even though you may cause pain.

If a doctor is not likely to come soon, you must substitute something for finger pressure as your fingers soon grow numb. To stop bleeding from the small arteries of face or scalp, put a tightly rolled or folded cloth pad directly over the wound, then wind a firm bandage around the head to hold the pad in place. Heavy bleeding from arm or leg wounds may require a tourniquet. A tourniquet can be made from flat materials such as a cloth belt, necktie, suspenders, handkerchiefs knotted together, or a strip cut from an inner tube. Do not use wire, rope, or sash cord.

A tourniquet should be used only for a hemorrhage so severe it threatens death. Using a tourniquet is a serious first aid measure, but it may save a life. In 1903 the Red Cross revised its directions for using a tourniquet. It says you should place the tourniquet close to the wound, but not at the wound edge. You must leave unbroken skin between the wound and

the tourniquet. If the wound is near a joint, wrap the tourniquet at the nearest point above the joint.

Be sure it is applied tightly enough to stop the bleeding. No matter how long it has been on, it should not be released except by a physician. There is danger of the victim losing a limb by gangrene through long application, but it is equally true that loosening the tourniquet at intervals may cause death. Experiences with casualties in the Korean conflict indicate that you can leave a tourniquet on for several hours without risk of gangrene.

You cannot apply a tourniquet to pressure points on the throat or behind the collarbone. Here you must continue finger pressure with someone relieving you.

In desperate cases when bleeding continues, you will have to pack the wound. Tear gauze or any cotton cloth into narrow strips. Take some slender instrument and force the strips down one by one until the wound is filled. Put on a bandage that will draw the wound together around the packing.

Anything that touches or enters an open wound should be sterilized. When this is impossible, use the cleanest material you can find. It is better to risk infection than to let a person bleed to death. In all other cases, however, you must guard against infection.

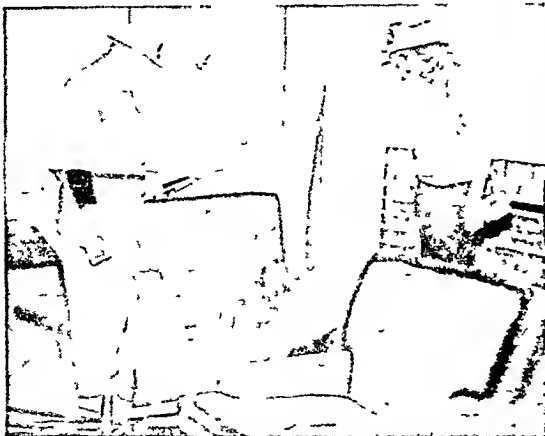
Bleeding from the Veins

Blood in the veins moves toward the heart. When a large vein is cut, apply finger pressure or a tourniquet.



TOURNIQUET APPROVED BY RED CROSS

The painted band on the wrist represents a bad wound. Note that the tourniquet is put near the wound but with some unbroken skin left showing. Only a doctor should loosen the tourniquet.



CIVIL DEFENSE WORKERS SEE RESULT OF ATOMIC BLAST TEST

This two-story frame house stood in the 5,500-foot zone of an atomic explosion. The blast heavily damaged it inside and out. The fallen mannikin represents a householder hurled to the floor.

The victim of any serious injury should be treated at once for shock. The first aid worker has wrapped a victim in blankets. Gently raising his head, she gives him a drink of a stimulant.

quiet on the side of the wound *away* from the heart. A pad or compress bandaged firmly over the wound then usually checks bleeding. If the vein lies deep in the flesh, you may have to pack it, as described earlier.

In all cases of heavy bleeding, keep the patient as quiet as possible, because exertion speeds heart action and increases the flow of blood. If the wound is in the neck or head, the patient should sit up; otherwise he should lie down with the wounded part raised above the level of the heart.

When Breathing Stops

Accidents and poisons can cause death by blocking the victim's breathing. Among them are drowning, electric shock, suffocation from smoke or gas, and overdoses of narcotics, ether, chloral hydrate, and "sleeping powders." After breathing stops, the heart may continue to beat for some minutes, but perhaps so feebly you cannot detect it. Start artificial respiration at once.

The best method of applying artificial respiration is the "back pressure-arm lift method." It is pictured earlier in this article.

Victims have been revived by this method four hours or more after the treatment began, so do not give up too soon. Keep the rhythm of the movements slow and regular. When you grow tired, have someone relieve you at the end of a count without breaking the rhythm. Keep the patient warm; if possible, with blankets over and under him, warmed by hot water bottles.

When natural breathing resumes, keep the patient absolutely quiet for a time. When he regains consciousness, hold up his head and give him stimulants, such as hot black coffee or aromatic spirits of ammonia.

Poisons

Children especially are likely to take poison accidentally. Poisoning ranks third in the causes of home accidents fatal to children under 14 years of age. Wise parents plainly label and put out of reach

such widely known poisons as rat poison, insecticides, kerosene, lye, and disinfectants. People should know that poisons are contained also in many detergents, shampoos, wave lotions, and household polishes.

If you suspect that a person has swallowed poison, call a doctor at once. While awaiting him, immediately give the person an *emetic*. An emetic is anything that makes a person vomit. He must vomit to get the poison out of the stomach. A good emetic is lukewarm soapy water. Use any soap. Have the patient keep drinking the suds until he vomits. If soap is not handy, use milk, dishwater, or lukewarm water with either salt or baking soda in it or plain lukewarm water. Usually you must give from four to seven glasses. If the patient still does not vomit, have him put a finger down his throat or do it for him.

After vomiting has washed out the patient's stomach you can give an antidote. The chief antidotes are described below, but if these are not handy give a heaping tablespoonful of Epsom salts.

There are two *exceptions* to using an emetic. They are poisoning by acid poisons and alkali poisons. With these poisons, vomiting may tear the stomach. Instead of using an emetic, neutralize the poison.

The *acids* include hydrochloric, sulfuric, nitric, and oxalic. To neutralize them, give the patient a glass of water containing a heaping tablespoonful of baking soda or milk of magnesia. Follow with a demulcent (a soothing substance) such as milk, egg white, olive oil, or any salad oil. Keep the patient warm.

The *alkalis* include lye, ammonia, and caustic potash. To neutralize these, give about two tablespoonfuls of vinegar or the juice of two lemons in a glass of water or a glass of orange juice. For a demulcent give milk or salad oil. Keep the patient warm.

Antidotes for Common Poisons

For *iodine*, give a glass of water with a tablespoonful of starch or two tablespoonfuls of flour. For *silver nitrate*, give a tablespoonful of salt in a

glass of water For *bichloride of mercury* stir raw whites of two or three eggs in half glass of water this must be followed with in two or three minutes by an emetic For *carbolic acid* give three tablespoonfuls of whiskey brandy or gin or a half and half mixture of grain alcohol and water Follow at once with an emetic

For *sleep producing drugs* give an emetic at once Follow with black coffee a cup every half hour or so To keep the patient awake slap and shake him Do not walk him very much

In *strychnine* poisoning an emetic is now recommended followed by Epsom salts in water Keep the victim quiet in a dark room Do not give a stimulant

In any case of poisoning if the victim stops breathing apply artificial respiration If he shows signs of shock use the treatment described below

Shock and Treatment of Shock

In the state of shock all bodily functions slow down as a result of the slowing down of the circulation of the blood Nearly every injury causes some degree of shock Severe shock can bring death

The symptoms of shock are a pale face cold or clammy skin weak but fast pulse and irregular breathing Often the patient is nauseated These symptoms may not appear for several hours Do not wait if the injury is at all serious Treat for shock at once

The first thing is to prevent loss of body heat Lift the patient carefully to place coverings over and under him Use whatever you have—blankets coats newspapers You may also add artificial heat such as hot-water bottles or heated stones or salt bags Put them at the feet and between and between the legs You must be cautious about the temperature because a

person in shock burns very easily Test the heat with your wrist then wrap the container before applying it Never put heat directly on the patient's skin Keep him warm but not hot enough to sweat heavily

Do not prop him up or put a pillow under his head Instead elevate his feet to keep his head lower When he can swallow you may give a stimulant such as hot coffee tea milk broth or a teaspoonful of aromatic spirits of ammonia in a glass of water If he is nauseated do not give a stimulant Never pour anything down the throat of an unconscious person

Sunstroke and Heat Exhaustion

When a person collapses from heat examine him most carefully He may have *sunstroke* (also called *heat stroke*) or *heat exhaustion* (also called *heat prostration*) The right treatment for the one would probably be fatal for the other

Despite its name sunstroke may occur without direct exposure to the sun The stroke usually begins with headache dizziness and dry mouth The skin is dry face flushed and hot pulse fast and hard The victim may fall unconscious or become delirious Cool him off at once Elevate the head and shoulders slightly then pour cold water on the head and body If possible wrap him in a sheet and drench it with cold water or plunge him into a tub of cold water Apply ice bags to his head Rub the legs and arms upward toward the heart Give him cool drinks but no stimulant

In heat exhaustion the face is pale and sweaty The body may feel cool and the head warm The pulse is weak and breathing is shallow Keep the patient warm and treat for shock A major cause of heat exhaustion is loss of salt from the body through very heavy sweating Give the patient salt in small amounts—



MAKING SPLINTS FROM EMERGENCY MATERIALS

A Civil Defense worker in first aid makes an arm splint from a tightly rolled newspaper and torn strips of cloth. The victim lies on his back with the injured arm across his chest.



This Civil Defense worker has put a blanket under the victim to check shock. She is splinting his leg with a bandage from a first aid kit and a stick of wood from the shattered house.

half a teaspoon of salt in one-third glass of water four or five times every half hour.

Broken Bones

When a bone is broken and there is no external wound, the injury is called a *simple fracture*, even though the bone may be broken in several pieces. When, however, the broken bone has cut through the skin or when a wound penetrates to the broken bone it is called a *compound fracture*. In treating any kind of fracture keep the ends of the broken bones from moving. If you can expect a doctor to arrive quickly do nothing at all except to see that the patient does not move. He will probably be in pain but keep him still.

If you have to move the victim of a simple fracture put on a splint to hold the broken bone firmly. Use any kind of firm material, even a rolled newspaper. If hard material such as wood or metal is used as a splint, pad the splint at the point where it touches the body. Before fastening the splint, very gently pull the limb into its normal position. Watch the broken limb and feel to see if it gets cold and in that case gradually loosen the splint to let the circulation come back normally.

For cracked or broken ribs, have the patient stand upright and take a deep breath, holding it to the count of 30, and wind handages or adhesive tape strips tightly across the shoulder and around the chest. When the patient releases his breath the binding will feel very tight. This is to keep the ribs from moving when he breathes.

Transporting an Injured Person

As you have read, never move an injured person until you have discovered what his injury is. Then if you must move him it is best to place him on some rigid support such as a wide board. You can also use a blanket. Roll the long edges tightly and then use the four-man lift. Two men on each side reach down

simultaneously, each on a bended knee to give lifting support. If you have no blanket, take jackets or shirts, push poles through the sleeves, and then button the garments inside out around the poles.

If no stretcher can be made a two-man carry can transport a victim gently. In the picture (opposite page) notice how the carriers place their arms and hands. They lock their grip to support the patient's hips and to support the shoulders and legs. The patient puts his arms around the carriers' necks.

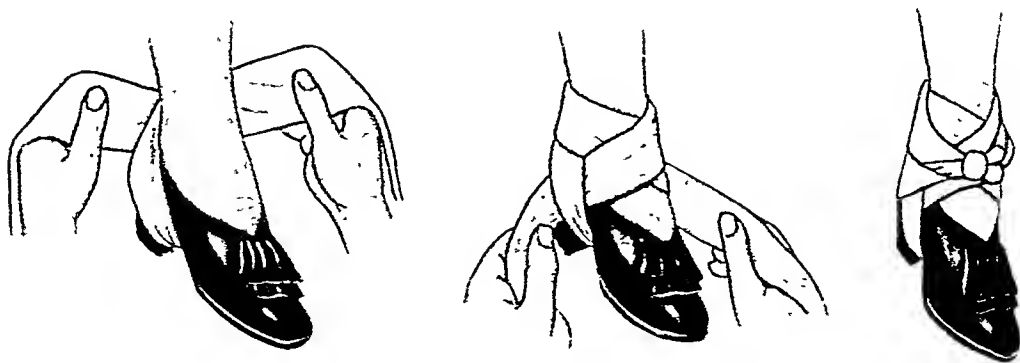
A one-man carry is the "fireman's lift." This, however, requires many hours of practice and should be studied only under experienced supervision. Another one-man carry is the "pack-strap" carry. In this the victim's arms reach from behind over the carrier's shoulders and are crossed over the carrier's chest, where he holds them tightly together or ties them. As the carrier leans forward the patient's feet are lifted from the ground and his weight is carried evenly over the carrier's back.

Disinfecting Wounds

As you have read, one of the first treatments in first aid whenever possible is to disinfect a wound. When a wound bleeds freely it may carry away foreign particles. It is, however, advisable to take precaution against infection. The most common antiseptic is mild tincture of iodine. Apply it inside the wound and around the edges, then put on a sterile compress firmly but not too tightly. Do not put iodine on the compress as it will cause blisters.

If you do not have an antiseptic make a pad of clean cotton cloth. Scorch the surface of the pad in a flame. Without touching the scorched surface with your fingers (as that is the part you sterilized) put the pad on the wound. If small bits of the charred surface drop onto the wound they will do no harm.

You may also gently wash the wound with sudsy soap and water. Do not rub; pat gently. Do not use any other germicide or disinfectant unless recommended



EMERGENCY BANDAGE TO SUPPORT A SPRAINED ANKLE

Have the victim keep on her shoe. Put the center of a tie or scarf under the shoe, just in front of the heel. Carry the ends up and back. Cross them above the heel. Bring forward, cross-

ing them over the instep, then down toward the arch to make a hitch under the bandage on each side, in front of the heel. Pull tight. Carry the ends back up across the instep and tie.



EMERGENCY TRANSPORTATION FOR DISABLED PERSONS

Red Cross students show how to lock arms and hands for the two men carry in the background. Each carrier puts one arm around the victim's back under the armpit, the other under the thighs.



This "fireman's lift" must be done expertly to avoid strain. The carrier puts his right hand between the victim's legs and grasps the victim's right hand, leaving the carrier's left hand free.

by a doctor or pharmacist or nurse. Some are poisonous and some may burn the flesh severely. Never put bare adhesive tape over a wound. You can use prepared adhesive strips fitted with gauze pads.

Puncture wounds such as those made by nails are especially dangerous because they seldom bleed enough to wash out germs. Tetanus or lockjaw often occurs. To prevent infection press down on the wound to make it bleed. Then take a small tuft of absorbent cotton wrap around the end of a toothpick or a whittled match, soak it in iodine and insert into the wound. Remove after a moment.

If the wound becomes seriously inflamed before you can reach a doctor, boil some water, add three tablespoonfuls of salt to the quart, soak a compress in the solution and put it on the wound as hot as the patient can stand it. Keep it in place for an hour, reheating the compress every few minutes by dipping it in the solution. Keep up the treatment for at least six hours. A doctor will give antitoxin. Antitoxin should be given also in case of wounds caused by gunpowder, fireworks or animal bites.

Common Accidents

To treat a blister put a little methyl tincture of iodine on the edge of the blister. Sterilize a thin needle by heating it in a flame. When it is cool use it to open the blister through the iodine-coated edge. Gently press on the outer edges to remove the water or blood. Cover with a sterile dressing. If the blister is large or the flesh around it remains inflamed see a doctor. To lessen the swelling of a bruise and to help check discoloration, apply ice or cold wet cloths at once. A bite by a cat, a dog or a human being should be treated as a puncture wound. If the skin is broken by the bite a doctor should be consulted.

Among the most common accidents are burns and scalds. Injuries from dry heat are called burns from

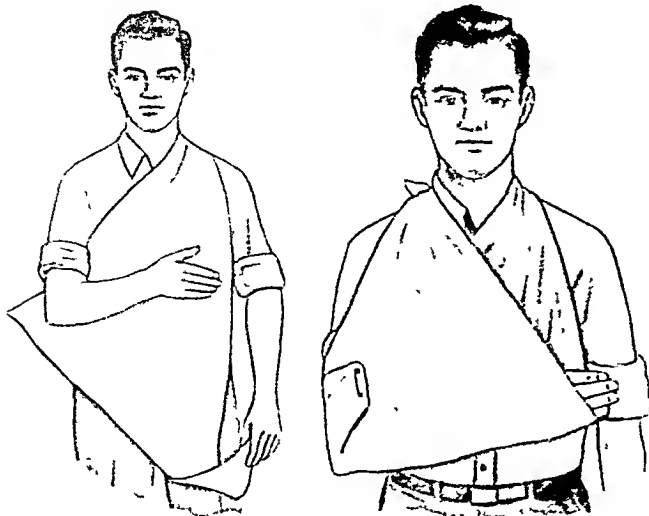
moist heat such as steam or hot water scalds. In first-degree burns the skin is red, in a second degree the skin is blistered, in third-degree the skin is charred. On a small first-degree burn use any good burn ointment or baking soda. Do not use oil or ointment on a large first-degree burn. Gently cover burns of this sort as well as second or third degree burns with a compress soaked in warm water containing three tablespoonfuls of baking soda to the quart. Keep the compress wet until the doctor comes. Never put iodine on a burn or a scald and never pull away bits of clothing that stick to a burn.

If someone begins to choke strike him between the shoulders with a sharp slap. If it is a small child hold him upside down as you slap him. When a person faints stretch him out on his back. Lower his head below heart level or elevate his legs to help the



STOPPING A NOSEBLEED

Have the patient sit down with his head tilted back. Put a large cold compress over his nose, pressing against the nostril which is bleeding. Do not let him blow for a while.



TRIANGULAR BANDAGE SLING

Put one end of the triangle over the shoulder of the uninjured side; put one point behind the elbow of the hurt arm. Bring the third end up over the shoulder of the hurt arm. Tie the two ends at the back of the neck.

blood return to the brain. Loosen his clothing, sprinkle cold water on his face, and pass smelling salts or ammonia under his nose. If he does not recover quickly, warm him with hot-water bags, but be sure they are not too hot. You can usually prevent a person from fainting by having him bend over until his head is on a level with his knees.

When you get something in your *eye* do not rub it. Gently pull the upper lid out and down over the lower lid and hold there for a few seconds till the tears can wash the particle to the corner of the eye. Never try to take out an object embedded in the eyeball or eyelid. Put a drop of olive oil or mineral oil in the eye and cover with a sterile compress until you can get a doctor. To kill an insect in the *ear*, insert a drop or two of olive oil or mineral oil. Have a doctor remove the insect. If a person has *swallowed* any hard object such as a button, pin, or coin do not give a laxative. Call the doctor at once. Do not scratch an *insect bite or sting*. Put on a paste of baking soda or a compress dipped in ammonia water.

For *poisoning by ivy, oak, or sumac*, gently wash the area with soap and warm water and follow with rubbing alcohol. You may put on a paste of mild soap for eight hours. Try to treat it before the rash develops. A doctor may give injections for prevention or for treatment. To remove a *splinter* first put on a mild tincture of iodine. Then sterilize your needle, tweezers, or knife point in a flame. After removing the splinter gently press the wound to make it bleed. Then touch with iodine and put on a compress.

Keep any *sprained joint* raised in a sling or elevated by pillows or some kind of prop. Apply ice bags or cold wet compresses until the doctor comes. If you must walk on a *sprained ankle* leave your shoe

on. The drawings in this article show how to make an emergency bandage support.

If a person has a *pain in the stomach* do not give a laxative, especially if nausea or vomiting accompanies the pain. The pain may indicate appendicitis and a laxative may rupture the appendix. Put the patient to bed. If pain or other symptoms persist call a doctor. If a person has a common *cold* have him rest in bed, keep out of drafts, and drink a quantity of fluids especially fruit juices. A teaspoonful of baking soda in a glass of water every two hours, taken three times, helps many people.

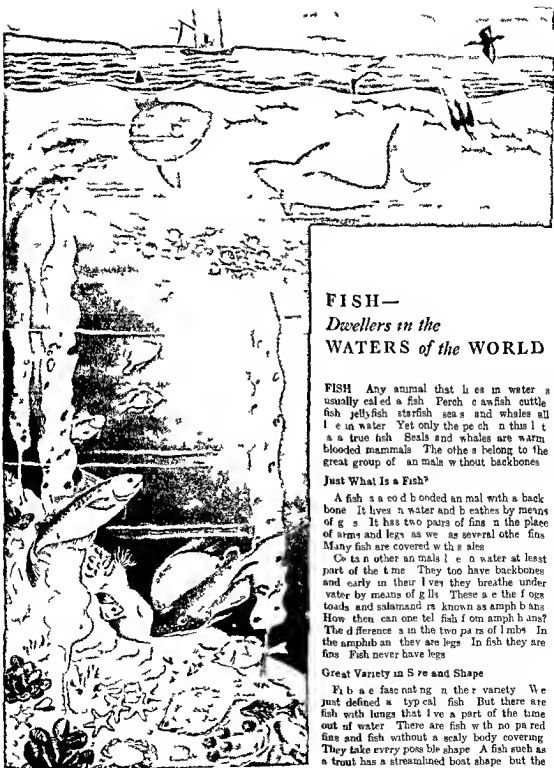
Put ointment on a split or cracked *finger*. Cover with a pad of gauze and adhesive tape. If the split or crack is not bleeding, you can draw it together by putting tape or plastic directly across the wound. Try to avoid hitting or knocking it.

A *nosebleed* usually soon stops without treatment, but if bleeding persists have the patient sit up, with his head slightly back. Have him breathe through his mouth. Loosen his collar or anything tight around his neck. Apply cold wet compresses over his nose. The nose usually bleeds from only one side. Pressing the nostril on that side against the middle usually stops the bleeding and lets a clot form. Press for at least four or five minutes. The patient should not blow his nose for a few hours. If this treatment does not stop the bleeding in a few minutes, call a doctor at once. Meanwhile gently pack sterile gauze back, but not up, into the nostril. Leave the end of the gauze hanging out so it can be removed easily.

Frostbite is often the result of carelessness, such as wearing inadequate clothing or staying out in the cold when overtired. It is more likely to occur during exposure to a high wind, which carries off body heat very quickly. Usually the victim does not feel any pain and may not even be aware of frostbite until someone notices the frozen, dead-white area. Do not rub frostbite with snow or with anything else. Rubbing may cause gangrene.

Have the victim hold his hand gently over the frozen area or cover it with any woolen cloth. If possible wrap the victim in blankets or extra clothing. As soon as possible get him into a warm room and give him a warm drink. Handle the frozen area very carefully. Apply lukewarm but *not* hot water for just a moment or gently wrap the frozen area in warm blankets. Do not use a hot-water bottle, a heat lamp, candle, or lighting lamp. Do not let the victim put the frozen area near a hot stove or fire. As soon as frostbitten fingers or toes are warm again, have the victim exercise them gently. If there are any blisters do not open them.

For further information on first aid work, see the American Red Cross First Aid Textbook. (See also *Camping; Safety.*)



FISH—

Dwellers in the WATERS of the WORLD

FISH Any animal that lives in water is usually called a fish. Perch, catfish, cuttlefish, jellyfish, starfish, sea anemones and whales all live in water. Yet only the perch is thusly a true fish. Seals and whales are warm-blooded mammals. The others belong to the great group of animals without backbones.

Just What Is a Fish?

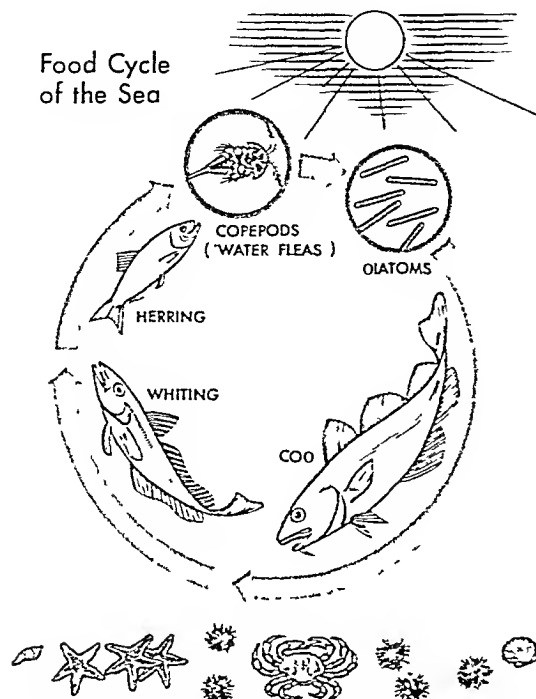
A fish is a cold-blooded animal with a backbone. It lives in water and breathes by means of gills. It has two pairs of fins in the place of arms and legs, as we see in several other fins. Many fish are covered with scales.

Contrary to other animals, fish live in water at least part of the time. They too have backbones and early in their lives they breathe under water by means of gills. These are the frogs, toads, and salamanders known as amphibians. How then can one tell fish from amphibians? The difference is in the two pairs of limbs. In the amphibians they are legs. In fish they are fins. Fish never have legs.

Great Variety in Size and Shape

Fish are fascinating in their variety. We just defined a typical fish. But there are fish with lungs that live a part of the time out of water. There are fish with no paired fins and fish without a scaly body covering. They take every possible shape. A fish such as a trout has a streamlined boat shape, but the

Food Cycle of the Sea



All animal life in the sea, as on the land, depends on plants. Cod eat whiting, whiting eat herring, herring eat copepods ("water fleas"), and copepods eat diatoms. Diatoms are tiny plants that depend on sunlight and minerals carried to the surface from the bottom of the sea by upwelling currents.

sea horse is a fish too, and it looks like a tiny horse standing on its tail. Eels and morays are long and slender, like snakes. Flounders are as flat as a dinner plate. The ocean sunfish looks like a huge head without a body.

The rabbit fish, a strange little relative of the shark, has a head and teeth resembling a rabbit. Even stranger is the oarfish. It looks like a horse with streaming red mane. A dweller of the deep seas, it has a bluish-silver body, compressed vertically like a ribbon, 50 feet long and weighing 600 pounds. A fin tipped with flaming red runs the length of the back and rises to a high crest over the long jaw. Tales of "sea serpents" may be explained by this fantastic creature.

Then there are the angler fishes which carry their own hook, line, and bait to catch other fish. The rod is an extension of a spine of the back fin. In one kind of angler it is jointed and can be cast forward and pulled back to the mouth. From its tip hang fleshy, wormlike tentacles that can be expanded and contracted. One of the deep-sea anglers has a luminous bulb at the end of the rod, which it dangles in front of its gaping mouth and flashes off and on to attract victims.

Size differs as much as shape. Certain Philippine gobies grow to be only a quarter of an inch long and weigh half a grain. The whale shark, largest of all fish, reaches 50 feet in length and a weight of 20 tons.

The Atlantic bluefin tuna may be 14 feet long and weigh as much as 1,800 pounds. Marlin also reach a weight of a thousand pounds. Sturgeons are the largest fresh-water fish. Some are 14 feet long and weigh more than a ton.

Where Fish Live

Fish live wherever there is water, except—there are exceptions to every statement about fish—in very salty water, such as the Dead Sea and the Great Salt Lake of Utah; and in water polluted by man in disposing of waste products. In such water fish cannot find enough oxygen to breathe.

They are found from the sunny surface of the ocean down to the blackest depths where the light never penetrates. Some can live in hot desert pools at temperatures of more than 100° that would cook most animals. Others spend their entire lives in the dark pools and streams of underground caves. In tropical countries are fish that are able to flop and crawl across mud flats and wet fields in search of food and fish that can burrow into mud when their pools dry up. They lie dormant for months if necessary, until the rains restore them to active life.

More than 20,000 kinds of living fish are known, and new species are discovered every year. This is more than all the other kinds of backboned animals combined. Another 20,000 fossil fish are known.

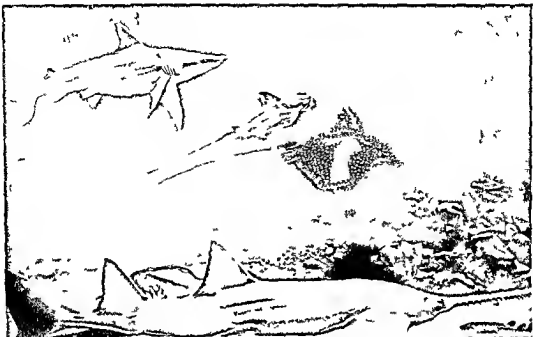
The Endless Food Chain

The greatest numbers of fish are found off the continental shelves of cold seas. Here thrive the tiny plants called *diatoms*, which are the basic food supply of the ocean's animal life. They attract hordes of fish, and here one finds the great commercial fisheries of the world—off the coasts of northern United States and Canada, in the North Sea, and around Japan.

Fish are found in smallest numbers in the deep sea where there is no light and no plant life. Here fish have nothing to eat but one another and whatever scraps drift down to them from above.

Most fish feed on fish smaller than themselves and are in turn the food of larger fish. Basically, however, all fish depend on the rich "pastures of the sea" known as *plankton*. A little more than half the plankton consists of one-celled plant life, the diatoms. The rest is made up of microscopic animal life—one-celled protozoans; eggs and larvae of fish and shellfish; tiny shrimplike creatures, the copepods, and countless others. Plankton drifts with the currents, like a thick, rich soup.

Enormous numbers of fishes, the great herring family for example, feed only on plankton. And herring in turn are the chief food of cod, pollock, and many others. In fact, whatever fish you wish to start with, you can run its food supply down to the plankton and finally to the diatoms within the plankton. In the sea, as on land, all animal life depends on plant life. (See Diatoms; Ocean.) Many fresh-water fish live on algae and other water plants, and many feed on insects and insect eggs and larvae. Fish are es-



SOME PRIMITIVE RELATIVES OF THE BONY FISHES
 (the shark (upper left) the rays (center) and the sawfish (bottom) are not awaiting victims on the ocean floor. They are mounted in a group at the Chicago Natural History Museum.

pecially important in controlling mosquitoes. Fish drink water and their body tissues contain enough fresh water to keep men alive who are lost at sea.

The Shape of a Typical Fish

The most highly developed fish are those with a bony skeleton. They are also the most abundant and the most familiar. The mackerel is a typical fish of this highest order.

Man, seeing how easily and swiftly the fish cuts the water, patterned his boats, airplanes, and submarines after its streamlined body (see Streamlining). It is spindle-shaped but somewhat wider in front of the middle. The head joins the body without a neck. The eyes are flush with the head; the gill openings are covered with a smooth flap. Only the fins extend beyond the body, and they can be pressed flat against the sides. Resistance is further lessened by a coating of slime.

Scales Record Fish's Life

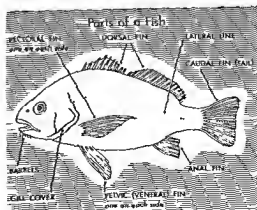
Most fish are covered with scales which overlap the body like shingles on a roof. The scales are not shed like hair or feathers, but if any are lost by accident new ones grow to take their place.

As the fish grows, the scales grow also by adding rings of new material around the edge. In summer when food is abundant, the rings are wide; in winter they are narrow. A fish does not eat when it is spawning (laying eggs), so the growth rings are narrow at this time. An expert therefore can learn a great deal about a fish, including its age and breeding habits, by studying its scales. Over the scales is a

layer of skin and the skin is coated with slime.

Unlike human beings, most fish continue to grow as long as they live. Old fish may become very large. The exceptions are fish such as the salmon which have a definite period of growth before spawning, and after spawning die. Carp are said to reach a life span of 100 years, but few fish in the wild die of old age.

The fins are composed of a web of skin supported by



THE PRINCIPAL PARTS OF A FISH

Fins vary greatly in number, position, size, and the use made of them. They may be spiny, rayed, or soft rayed. Not all fish have a lateral line. The barbels, or feelers, are found chiefly in bottom dwellers which use them to find their food in the mud.

horny rays. Two pairs of fins correspond to arms (pectoral fins) and legs (pelvic, or ventral, fins). There are also several unpaired, or median, fins—dorsal (back), caudal (tail), and anal (on the belly). Fish never have more than two pairs of paired fins, but a few fish have none—the eels, for example. The median fins vary considerably in number.

How Fish Swim

Fish swim chiefly by sideways muscular movements of the body and sweeps of the tail. The fins are used for balancing, steering, and braking.

Fish were using JATO (jet-assisted take-off) long before airplanes. To move quickly from a resting position the fish shoots a stream of water out of the gills and lunges forward by jet propulsion. Flatfish jump straight up from the sea floor by shooting water out of the gill on the underside of the head.

The fastest swimmers have a deeply forked, half-moon tail, like that of the tuna. These fish can travel 30 miles an hour. Other maximum speeds over a short distance include sailfish, 68 miles an hour, salmon, 25 miles, trout, 23 miles, perch, 10 miles.

Many fish are able to jump considerable distances

(see Salmon). Flying fish and sailfish have enlarged pectoral fins that serve as gliders when the fish hurl themselves out of the water (see Flying Fish). Some fish walk. The tropical gurnards, or sea robins, step over the ocean floor on the fingerlike rays of their pectoral fins. The walking perch of southeastern Asia cross land to migrate from one pond to another. They travel in a clumsy, sprawling fashion by spreading out the gill covers and fixing them to the ground by sharp spines, then giving a vigorous shove with the tail and pectoral fins.

How Fish Breathe

A heart pumps the red blood through the body of a fish, just as it does in higher animals. Most fish breathe by means of gills. They consist of many tiny filaments supplied with blood vessels. Water enters the open mouth. Then the fish closes its mouth and the water is forced over the filaments and out through the gill covers. Oxygen dissolved in the water is absorbed into the blood stream through the delicate membrane of the filaments. Inside the mouth are straining devices called gill rakers. They prevent food from passing over and injuring the gills.

Some fish breathe by means of both gills and simple lungs. The mudfish is an example (see Mudfish). Various tropical fish of stagnant pools and muddy shores—the walking perch, skipping gobies, and blennies—come to the surface at intervals to gulp air. Most fish have an air bladder, also called a swim bladder. It is a long sac filled with gas, between the stomach and the backbone. Its purpose is not clear, but it has been regarded as a balance to keep the fish suspended in the water. In the air-breathing fish it serves as the lung.

Senses of Fish

The brain of a fish is poorly developed. The cerebrum, which in man is the center of thought and rea-



WALKING, AIR-BREATHING MUDSKIPPER

The mudskipper, or skipping goby, of tropical shores can breathe air. It travels over mud by means of armlike pectoral fins and a strong tail. It lives in a burrow which it digs itself. The eyes are mounted on stalks and can turn in all directions.



GREEN MORAYS AND AN AUSTRALIAN SEA HORSE

Morays (left) are large eellike fish. They coil up among rocks and strike out at their prey with needle-sharp teeth. The dorsal



fin is a long fringe on the back. This strange little fish (right), trailing leaflike growths, looks like a bit of floating seaweed.



CAMOUFLAGE AND PROTECTIVE COLORATION SERVE AS DEFENSE AGAINST ENEMIES

The leaf fish (left) as it swims head down looks like a dry brown leaf drifting down from the surface of the water. It even has a short stalk on its lower lip that resembles the stem of a leaf.

It lives in the Amazon River. The slender mottled green pipefish (right) can hardly be distinguished from the long blades of seagrass in which they live.

sensing is missing entirely. Hence a fish probably does not experience pain when it is hooked on a line even though it has a sensitive nervous system.

The eye is similar to that of other backboned animals. There is no need for eyelids to keep the eyes moist. Fish are nearsighted and can distinguish colors. Flatfish have both eyes on the same side of the head (see Flatfish). Some cave fish are blind. Some deep-sea fish develop enormously enlarged eyes and eyes that are mounted on stalks like telescopes.

The four-eyed fish of Central and South American rivers swims on the surface of the water. The eyes are divided by a black horizontal line across the center. The upper half is adapted for seeing in air; the lower half for seeing in water.

Eyesight may be very sharp. The Siamese archer fish feeds by knocking insects off twigs several feet above the surface of the water with a drop of water spit from its mouth. Its aim is perfect.

Sense of smell is located in deep pits in the head. In some fish it is very keen. Sharks are attracted from a great distance by the odor of blood.

Ears are buried deep in the head, but fish apparently hear for they can be trained in an aquarium to come to the side of the tank for food when a bell is rung.

Unique Senses of Fish

Most fish have a lateral line extending the length of the body. It consists of a row of nerve cells. Probably this line helps the fish to feel movements in the water such as the approach of another fish. With the sensitive barbels, or feelers around the mouth of the bottom-dwelling fish search for food.

Certain kinds of fish travel in great groups known

as schools or shoals. The precision with which such schools swim in formation, twisting, diving, speeding up in unison with their leaders, never colliding, is one of nature's great mysteries. Whether they maneuver by sight, sound, or response to vibrations in the water from the lead fish, no one knows.

Strange Noises under the Water

Fish have no voice, but they make sounds as the United States Navy learned during World War II when underwater noises caused confusion in submarine detection. With the Federal Fish and Wildlife Service, the Navy identified and made phonographic records of the various fish sounds.

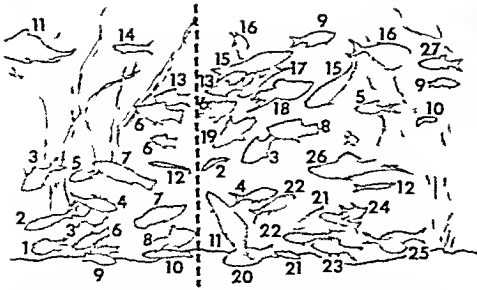
Booming, drumming, and grunting noises are produced by the air bladder. Croakers are among the noisiest fish. Their two- and three-beat drum rolls are made by the action of certain drumming muscles against the air bladder which set it vibrating. Ocean sunfish and hogfish grind their teeth. Other fish scrape their fins against their bodies.

Protective Color and Camouflage

Nearly all fish are protectively colored to resemble their surroundings and deceive the eye of enemies (see Protective Coloration). In the tropics many fish are as brilliantly colored as jewels. Yet they are protected by such tricks of camouflage as disruptive marks, vertical black or white stripes which break up the outlines of the body and make it hard to see. Eyes are bright objects at which an enemy might strike. Often the stripes of the head are carried onto the eye through the iris, making it nearly invisible.

Some fish change color and pattern with the back-

FISH



TROPICAL FISH, NEW YORK AQUARIUM

The most popular kinds of tropical fish were gathered in one tank to make this picture. The fish could not live together or in such numbers in a home aquarium. The key picture above and the list below identify them.

- 1 Golden Barb—southeastern Asia
- 2 Red-Fin Tetra—Brazil and Guianas
- 3 Sumatra Barb—Siam (Thailand) and Malaya
- 4 German Flag-Fish—Brazil
- 5 Red Rasbora—Malaya and Sumatra
- 6 Red Platy—domestic variety
- 7 Black Mollie—southern United States
- 8 Black-Wag Platy—domestic variety
- 9 Zebra Danio—India
- 10 Guppy—Trinidad and Venezuela
- 11 Betta—Siam
- 12 Pencil Fish—northern South America
- 13 Platy—Mexico, Guatemala, and British Honduras
- 14 Pearl Danio—Burma
- 15 Giant Danio—India and Ceylon
- 16 Hatchet Fish—Brazil
- 17 Black-Wag Swordtail—domestic variety
- 18 Swordtail Platy—domestic hybrid
- 19 Small-headed Characin—Brazil
- 20 Dwarf Cichlid—South America
- 21 Neon Tetra—Brazil and Peru
- 22 Ohllique—Brazil
- 23 Red-nosed Tetra—Brazil
- 24 Glo-Lite Tetra—Guianas
- 25 Head-and-Tail-Light—British Guiana and Brazil
- 26 Red Swordtail—domestic variety
27. Swordtail—Mexico, Guatemala, and British Honduras



ground on which they are lying. Groupers and flatfish are particularly effective in matching their surroundings. Color change in these fish is controlled through their eyes. If the fish is blinded it loses the power to change. Color change also takes place if a fish is frightened or angry. Violent emotions react on the pituitary gland and cause it to pour hormones into the blood stream. The hormones in turn affect the color cells.

What Causes Color and Pattern

Color and pattern in a fish are caused by the grouping of color cells. These cells, and particles which reflect light, are located between the scales and the skin which covers the scales. Each cell is shaped like a many-armed star, and each contains pigment of a single color. The pigment can become almost invisible by retracting into the center of the star; or it can expand out into the arms, exposing its color in varying degrees. The amount of pigment exposed to view,

combined with the pigment in other cells, determines the color pattern of the fish. Secretion from the pituitary gland causes the color cells and pigment to develop. Most newly hatched fish are colorless and transparent, making them almost invisible to enemies. The color cells do not develop until they are older and better able to defend themselves.

The beautiful iridescence of a fish is caused by crystals of *guanine*. This is a waste product of the blood which is deposited in the skin.

Weapons and Defense

Fish have a variety of defenses against their enemies. Size and speed give the advantage to such fish as the tuna, salmon, tarpon, and shark. The sailfish, swordfish, marlin, and sawfish have snouts prolonged to form long, wicked spears and saws. Barracuda and the murderous little piranha have vicious teeth. The piranha has been called "the most ferocious fish in the world." Schools of these fish of South



American rivers can consume the flesh of a swimming man or animal in an unbelievably short time

There are electric fishes capable of delivering a paralyzing shock (see Torpedo Fish) Spines on fins and gill covers many of them provided with poison glands inflict extremely painful and even fatal wounds on men and animals The barbed tail of the sting ray and the pectoral fins of a catfish called the mad tom are examples

Strange Relationships of Fish

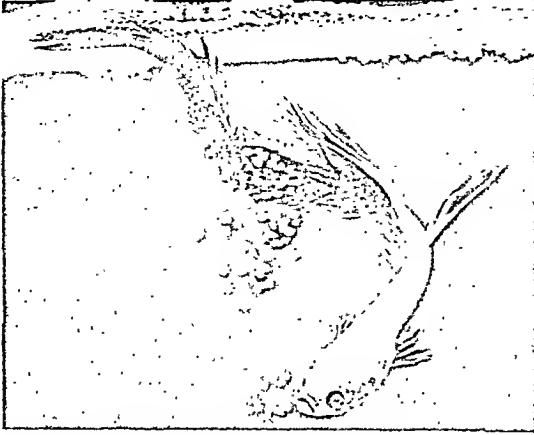
Some fish live together in a curious relationship called *symbiosis* Giant morays permit little butterfly fishes to swim in and out of their mouths in search of parasites The damselfish hides among the tentacles of the sea anemone Mysteriously safe from the anemone's sting it lures larger fish which the anemone kills Then the damselfish shares in the leftovers of the feast In the same way the sheppard fish lives among the tentacles of the Portuguese man-of-war a jelly

fish The shark sucker or remora fastens itself to the body of a shark by means of a suction disk on the top of its head It too shares in the shark's kill

Eggs Nests, and Young

All fish hatch from eggs Usually the females and males release the eggs and the milt (fish sperm) into the water There they meet and the eggs are fertilized only by chance Eggs may be released in long sticky strings that cling to rocks or seaweeds or they may float on the surface becoming a part of the plankton Some are covered with oddly shaped leathery cases (for picture see Egg) Sometimes the eggs are fertilized in the female's body and hatch there Guppies and some of the sharks are live born The young that hatches from the egg is known as a larva It feeds on minute organisms in the water The development into the form of the adult fish differs with each kind

Egg laying has many interesting variations The female sea horse lays her eggs in a kangaroo-like



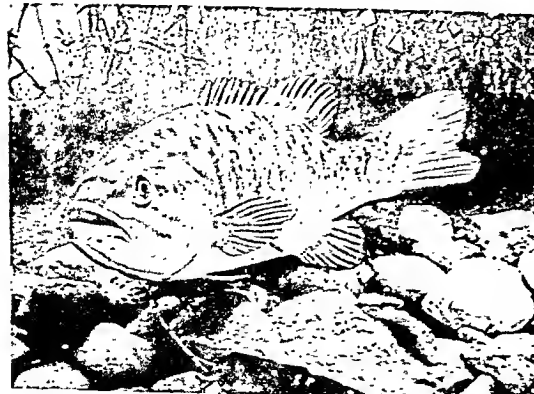
THE BETTA'S BUBBLE NEST

The male Siamese fighting fish, or betta, builds a nest of bubbles. As the female lays her eggs he catches them in his mouth and places them in the nest, which he guards until the eggs hatch.



PLANT NEST OF THE STICKLEBACK

The male four-spined stickleback builds a nest much as a bird does, weaving plant material around a framework composed of a clump of weed stalks. After the female lays the eggs, he roofs over the nest and guards it until the young have hatched.



STONY NEST OF THE BASS

The male smallmouthed bass makes a nest of stones, cleaned of all sediment. The female lays the sticky eggs on the clean stones. The male fans the eggs with his fins and guards the young.

pouch on the abdomen of the male, where they stay until they hatch (*see* Sea Horse). One of the male catfishes carries the eggs in his mouth. Until they hatch, in a month or so, he is unable to eat. The male frogfish picks up the eggs deposited by the female and blows them from his mouth, along with bubbles of mucus. The mucus hardens about the egg mass and forms a light floating bag.

Male Nest Builders

The male stickleback builds a nest of waterweeds (*see* Stickleback). The male Siamese fighting fish, or betta, makes a bubble nest on the surface of the water. He blows bubbles from his mouth, each coated with a sticky matter which prevents the bubble from bursting and makes it stick to the others. As the female releases the eggs he catches them in his mouth and places them in the nest. Then he drives the female away and mounts guard over the nest. If an egg drops out he immediately replaces it.

Some kinds of fish, among them the salmon and shad, leave the sea and ascend to the headwaters of rivers to deposit their eggs. Others, such as the eel, live in fresh water and go to sea to spawn. They make most marvelous migrations to the same waters in which they were hatched perhaps years before (*see* Eel; Migration of Animals; Salmon).

Marvelous Instinct of the Grunion

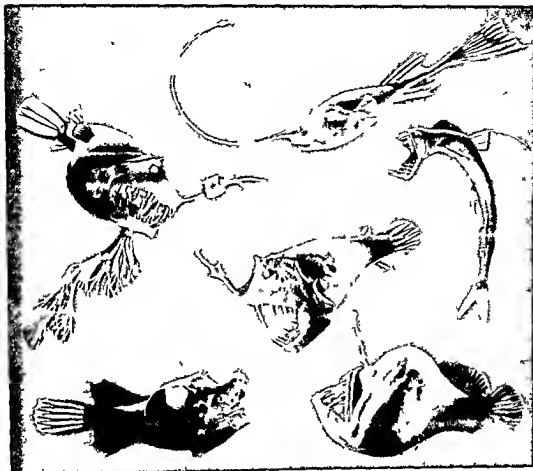
As mysterious as the migration of the salmon and the eel is the sensitivity of some fish to the rhythm of the tides. The silvery grunion appear in the surf off the coast of southern California shortly after each full moon and each new moon, from March through July. As the twice-monthly high tide reaches its peak and begins to ebb, these little smeltlike fish ride ashore on the crest of a wave in the moonlight. With lightning speed the female digs a hole in the sand with her tail, lays her eggs, and the nearest male fertilizes them. Then they wriggle back onto a receding wave and are carried away to sea. Only 20 to 30 seconds have passed.

The young hatch in 10 to 12 days and are washed out to sea on the next high tide. If the eggs were laid any closer to the water on a lesser tide they would be washed away before they were ready to hatch.

Fish that shed their eggs into the ocean must lay enormous numbers. A large cod produces about 8 million eggs every year. If only two reach maturity the survival of the race is assured. In general, the greater the parental care, the fewer the eggs.

Deep-Sea Fish and Luminescence

In the dark abysses of the deep sea the only light is produced by the fish themselves. Some of them glow by means of a coating of luminous slime. Some have luminous bacteria on their bodies. The lamp-eyed fish, for example, has eye sockets in which live millions of bacteria that shine with their own light. Others have light organs, with lenses and reflectors, located in the skin. These lights can be turned on or



STRANGE RESIDENTS OF THE DEEP SEA

Deep-sea fish are terrifying hunters, many of them with complicated light organs which serve as bait to attract prey. The anglers carry the bait at the end of a rod. The fish at upper left can flash the lamp on its snout off and on. The long whiskers are organs of touch. Enormous jaws and ferocious teeth are common. (Photographs by Fritz W. Goro, courtesy of *Life Magazine*.)

off as the fish wishes. There is the lantern fish with an upper row of red, blue and violet lights, a lower row of red and orange lights and red lights in the tail. Another fish looks like an ocean liner at night with rows of glowing portholes along its sides. Most fantastic of all are the various angler fishes which use an electric bait. The lure is a whiplike extension of the dorsal fin. At its tip is an electric light bulb which acts as a lure.

These fish are savage hunters. Huge mouths, hinged teeth that fold backward and stomachs capable of being enormously extended permit them to swallow fish larger than themselves. Most of them have soft, thin bones, jellylike flesh and are either inky black or a ghastly gray in color.

Migration and Hibernation

We have spoken of the migrations made by salmon and eels to spawn in the same waters in which they were born. Oceanic fish such as the tuna also migrate in search of food (see Tuna). Some fresh water fish hibernate. Carp retire to the bottom of lakes and

spend the winter partly buried in mud (see Carp). Pike and others move to deep water where fishermen catch them through holes cut in the ice (see Pike).

In tropical countries many fish sleep through the summer months (estivate) when swamps and rivers dry up. Walking perch and lungfish bury themselves in mud, leaving only an air hole open and breathe by means of their lungs. One of the gobies of the Ganges River delta digs a burrow and sleeps through the dry months with only the tip of its tail touching water. It apparently breathes through its tail.

Modern Remains of Prehistoric Fish

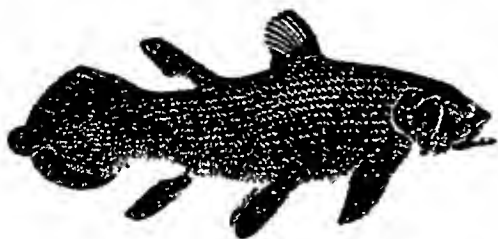
Fish are regarded as the first backboneed creatures to develop on the earth. In the Devonian Age and Coal Age they were the chief type of animal life (see Geology). Fish evolved along several different

lines. The most primitive of all vertebrates are the lampreys and hagfishes. The backbone is a rod of gristle, called a notochord. There are no jaws and no paired fins. The gills are formed in a pattern not found in any other living fishes. The mouth is a round opening with a rasping tongue-like organ (see Lamprey).



THE AIR-BREATHING MUDFISH

The South American mudfish, or lungfish, must come to the surface at intervals to breathe. It burrows into mud in dry periods.



A LIVING FOSSIL

The discovery of a living coelacanth was as exciting as though a living dinosaur were discovered. This is a mounted specimen of the world's oldest fish, found in the Mozambique Channel.

Sharks, skates, and rays are a step higher in development. They have a skeleton of cartilage. The jaws are on the underside of the head. The body is covered with toothlike structures of enamel called denticles. (See also Sharks; Skates and Rays.)

Fishes with a bony skeleton are the most highly developed. At first they had a body covering of enamel plates. Gars still retain this hard, or *ganoid*, protection. Related to these primitive fish are the sturgeon paddlefish, and bowfin. (See Gar; Sturgeon.)

In the Devonian Age and Coal Age, swamps and streams periodically dried up or became shallow and stagnant. The creatures living in them were forced to crawl on land and breathe air. They developed lung-like structures, and fins with fleshy lobes, within which were bony supports. From such air-breathing crawling creatures developed amphibians, reptiles, birds, and all other backboned animals. The mudfishes still have these simple lungs and fleshy lobed fins (see Mudfish).

An Exciting Scientific Discovery

Another fish common in the early history of the earth was the *coelacanth*. Scientists knew it only from fossils and assumed it had been extinct for millions of years. In 1938 a living coelacanth was caught off the coast of South Africa. The fish was badly decomposed by the time scientists reached it. In 1952 another was caught in the Mozambique Channel. A South African scientist, Dr. James L. B. Smith of Rhodes University, flew to the scene in a government plane in order to bring it back in good condition. It was about five feet long and weighed 120 pounds. It had a large head covered with heavy enamel plates, and leglike fins, all characteristic of ancient fish. Several other males have since been found. It is believed that the females may live at a greater depth and hence are never caught in fishermen's nets.

The world's most primitive bony fish, the coelacanth is expected to throw light on the evolutionary history of vertebrates. (See also Aquarium; Fish Culture, Fisheries; Fishing; Zoology.)



SHOVEL-NOSED STURGEON

Sturgeon have sharklike tails and five rows of enamel plates along the sides of their bodies. Sturgeon, mudfish, and the coe-

lacanth are primitive types of bony fishes which were the prevailing kinds in the Devonian Age of Fishes and the Coal Age.

RAISING and STUDYING FISH

FISH CULTURE When Europeans first discovered North America the codfish were so thick they could be scooped up in baskets. Bears waded into the water and caught them with their claws. John and Sebastian Cabot in 1497 named the land Baccalao the Basque word for cod. Other food fishes in the coastal and inland waters were equally abundant. The first permanent settlements in North America were fishing villages and the earliest industry of Canada and the United States was the fishing industry.

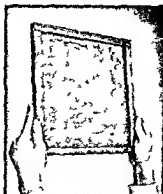
Need for Conservation

As fishing increased it became apparent that the future supply was being endangered. This was especially true of the fishes of inland streams and of those which ascended the rivers from the sea to spawn as do the salmon. The spread of cities caused even more damage than overfishing.

Sewage and industrial waste dumped in to rivers and lakes pollute waters and kill the fish. Dams block the movements of migrating fish traveling upstream to spawn. Drainage projects destroy fishing grounds. Soil erosion by filling the streams with silt kills the plant foods of fish covers their spawning beds and reduces the oxygen in the water so they cannot breathe (see Conservation).

It soon became necessary to regulate commercial fishing and to restock inland waters. Canada established a department of Marine and Fisheries at Confederation in 1867. The United States took up the work in 1871 when Congress created the Office of Commissioner of Fish and Fisheries. Even before that time several states had established commissions. In 1903 the Fish Commission became the Bureau of Fisheries in the Department of Commerce. In 1940 the bureau was merged with the Bureau of Biological Survey to form the Fish and Wildlife Service in the Department of the Interior or (see United States Government). The service now maintains nearly a hundred hatcheries and distributes hundreds of millions of young fish and fertilized eggs. The states and Canadian provinces also support hatcheries.

The International Fisheries Commission formed in 1923 regulates the Pacific coast halibut catch of Canada and the United States. This species once



THE WORK OF A FISH HATCHERY

Eggs are removed from the dead salmon (left) which die after spawning any way. The eggs are put on screens (right) and suspended in troughs of water.



MARKING SALMON FRY IN A HATCHERY

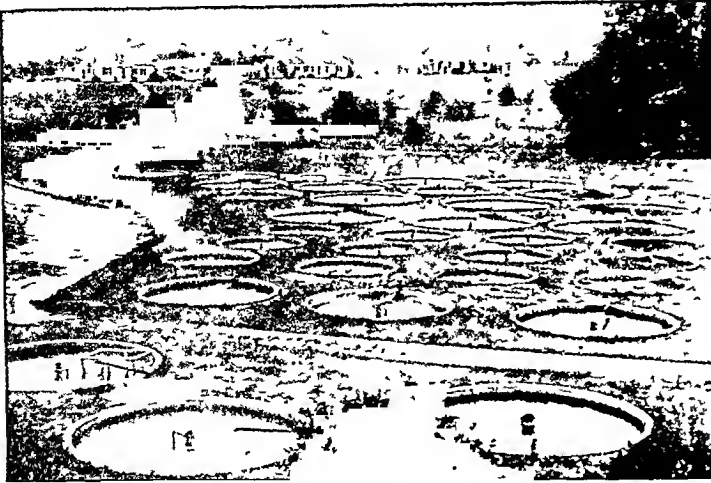
These women in a Washington state fish hatchery are clipping the fins of salmon fry before releasing them into the streams where they will mature.

threatened with extinction was saved by wise conservation measures (see Halibut).

The Work of a Hatchery

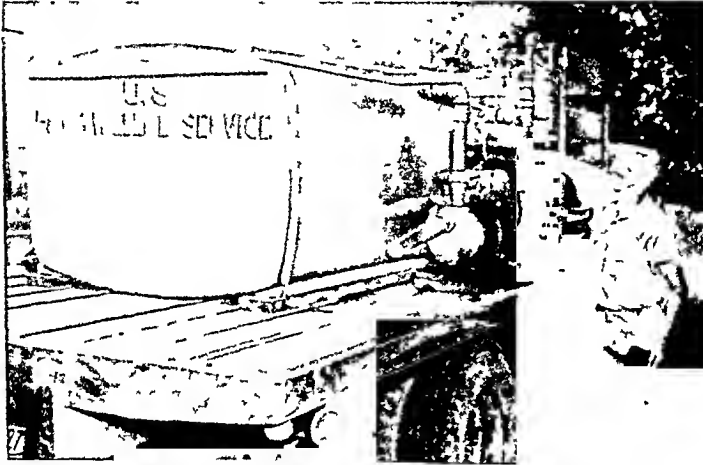
In the hatchery of a fish culture start on the eggs are stripped from the females and fertilized by mixing with milt from the male. The fertilized eggs are kept in pure aerated water at the proper temperatures for their development. They may be kept in open tanks or in jars depending on the species. In Pacific salmon hatcheries the fish are killed before the eggs are removed. This causes no loss because the fish die anyway after spawning.

The newly hatched fish are retained in the tanks for several weeks then transferred into rears or pools where they grow and starved. Until the fish begin to feed they are known as fry and until they are an inch long as advanced fry. After this until they are a year old they are fingerlings and from one year to two years yearlings. It is estimated that on natural spawning grounds only 15 per



WHERE YOUNG FISH GET A START IN LIFE

In pools such as those in the picture above, young trout grow after they have left the hatching troughs. The pools are provided with fresh water charged with oxygen.



A FISH-MOVING TRUCK OF THE FEDERAL GOVERNMENT

When the fish are ready to be released in streams and lakes, they are moved from the hatchery in specially constructed tank trucks. The tanks are aerated.

cent of the eggs are hatched. In the fish hatcheries, at least 80 per cent are saved.

The young fish are carried in specially constructed tank trucks or by air to all parts of the country.

Each kind is set free in suitable waters. The eggs can also be sent long distances packed in moss and ice.

The federal government devotes most of its work to the various species of salmon of the Pacific coast, and to the numerous trouts, basses, and other food and game fish of interior waters. Other valuable aquatic life, such as oysters, lobsters, terrapin, and even sponges, also come under the protection of the government.

Tagging of Fish

Fishes are tagged at the hatcheries in order to learn something about their migration and life history. A metal or celluloid disk is attached to one of the fins, the jaw, or gill cover. Each disk bears a number which is recorded when the fish is tagged. Fishermen who return the disks with information on the date and place of capture of the fish to the Fish and Wildlife Service receive a small cash award for each tag. Salmon are marked by clipping the fins.

The government also collects statistics on the numbers and kinds of fish caught at the ports and with what kind of fishing gear.

Farm Fishponds

Farm fishponds have become important as a source of food for the home and as a cash crop. Federal and state hatcheries provide fingerlings and instruct farmers on how to "balance" the pond. Bluegill and largemouthed black bass are most suitable for farm ponds. Stocked in proper numbers, the young of the bluegill provide food for the bass. Enough bluegill remain to reach maturity. Commercial fertilizer in the pond stimulates production of microscopic plants. These are eaten by water insects; the insects, in turn, are the principal food of the bluegill and bass.

FISHERIES—An Important FOOD INDUSTRY

FISHERIES. Since the earliest days of history men have fished for their food in seas, lakes, and rivers. Today the catch of the fisherman appears on the dining tables of every country in the world.

Every year about 30 million tons of fish are caught for human food. Yet more than half the people in the world are underfed. They are most deficient in high protein foods, the bodybuilders. Fish are among the chief sources of protein. If the steadily increasing population of the world is to be properly nourished,

new sources of food fish must be found and developed.

Commercial fishing in the United States and Alaska employs 160,000 fishermen and produces 4½ billion pounds of fish every year, valued at about 350 million dollars.

A second important industry is sport fishing. In one year more than 17½ million fishing licenses were issued to fishermen, for which they paid about 35½ million dollars. Manufacturers of fishing tackle, boat captains, bait dealers, and owners and employees of

fishery resorts all earn a living by contributing to pleasure fishing. (See also Fishing.)

A popular hobby is keeping aquarium pets (see Aquarium Hobbies). Some 10 million people have home aquariums. A large importing trade has been built up to provide them with 150 different kinds of tropical fish. Domestic dealers breed small fish and water plants and the manufacture of aquarium tanks and appliances increases in value every year.

The term fisheries means the taking of all kinds of water products for commercial purposes. Thus it includes the hunting of whales, seals and other mammals as well as shellfish, frogs, alligators, turtles and even pearls and sponges. The greater part of the industry, however, is concerned with the taking of true fish for food.

Food Elements in Fish

Fish are rich in protein, minerals and other elements essential to the diet of man. Cod liver oil, halibut liver oil and other fish oils are valuable for their vitamins A and D. Salt water fish contain iodine important in the prevention of common goiter.

Chemists have developed an egg white from fish albumen. One pound is the equivalent in food value of 150 eggs. Fish flour has also been developed. Mixed with regular flour, it increases the protein content of a loaf of bread.

Some fish, such as the menhaden, are taken almost solely for manufacture into meal and oil. Fish meal contains proteins, vitamin B₁₂ and an unidentified growth factor which makes it particularly desirable as stock and poultry feeds. The principal use of fish oils is in the manufacture of linoleum, paints, soap and a rust-resistant oil.

Fisheries of the United States

About 160 different kinds of fish and shellfish are taken commercially, but only 10 account for 75 per



DRESSING DOWN THE CATCH

These Gloucester fishermen must clean and salt the catch on shipboard because fish spoil rapidly. Birds hover overhead, ready to seize the scraps of refuse thrown into the sea.

cent of the catch. These are menhaden, pilchard (sardines), tuna, herring, salmon, ocean perch (formerly known as rockfish), shrimp, crabs, haddock and jack mackerel.

The leading fishing ports in the United States are San Pedro, Calif. (tuna, pilchard, Pacific and jack mackerel), Gloucester, Mass. (ocean perch), Lewes, Del., Cameron and Empire La. and Pascagoula, Miss. (menhaden), Boston, Mass. (cod, haddock, pollock and whiting) and San Diego, Calif. (tuna).

The Great Lakes have the most important of all lake fisheries. Their principal products are lake herring, chub, pike, perch and carp. The rivers of the United States, especially the Mississippi and its tributaries, abound in catfish, buffalo fish, carp, sheepshead and mussels.

FOOD PRODUCTS

From flesh and Roe

Human food

Protein

Minerals

Calcium, phosphorus

magnesium, sulfur

iron, copper, iodine

Vitamins

A, D and others

Poultry and livestock feed

What a Fish Can Yield



Scales

Artificial pearls

Head

Glue, fertilizer, animal feed

Air Bladder

Gelatin used in making jelly, wine, beer, cement

Bones, Fins, Entrails

Fertilizer, animal feed

DRUGS

From Entrails

Vitamins

Medicinal oil

Amino acids

Insulin

Hormones

Enzymes

INDUSTRIAL PRODUCTS

Oils Express from Body Used in

Soap

Lubricants

Paint

Shortening

Tanning

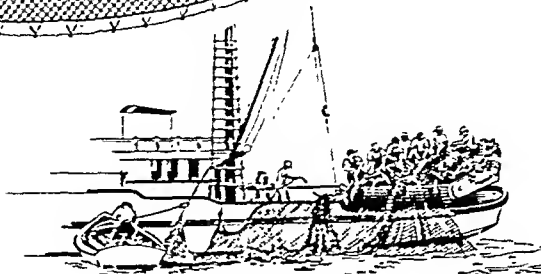
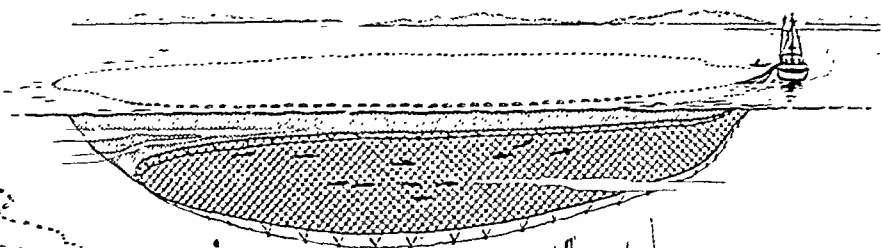
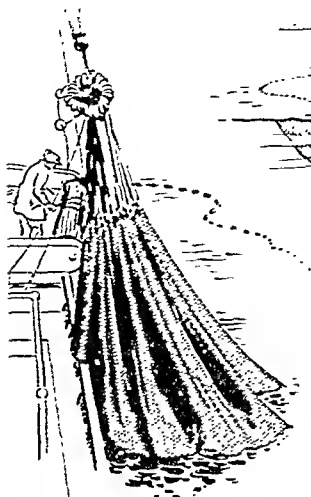
Printing ink

Metal plating

Tempering steel

Shark Skin

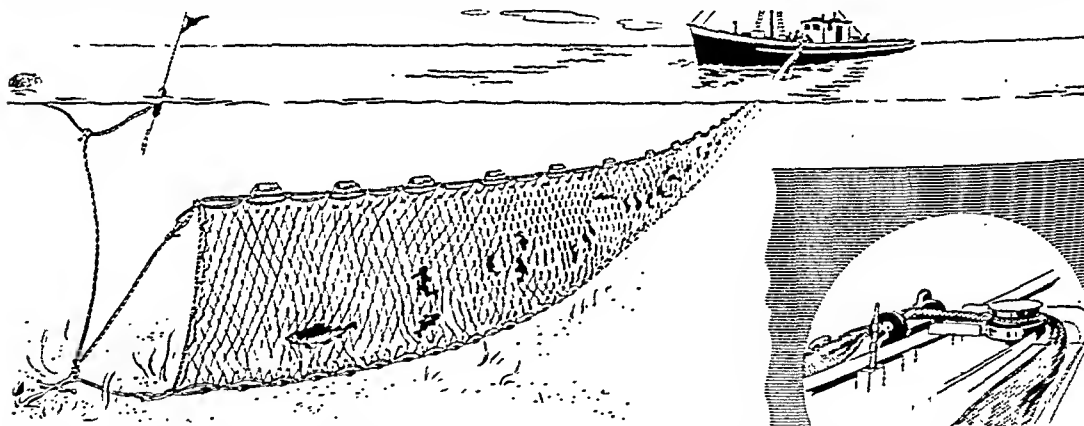
Leather, metal smoothing and polishing



SALMON PURSE SEINING

The power hoat has payed out the purse seine, which may be 1,500 feet long and 150 feet deep. The other end of the net was attached to a dory. The drawing shows the ropes by which the

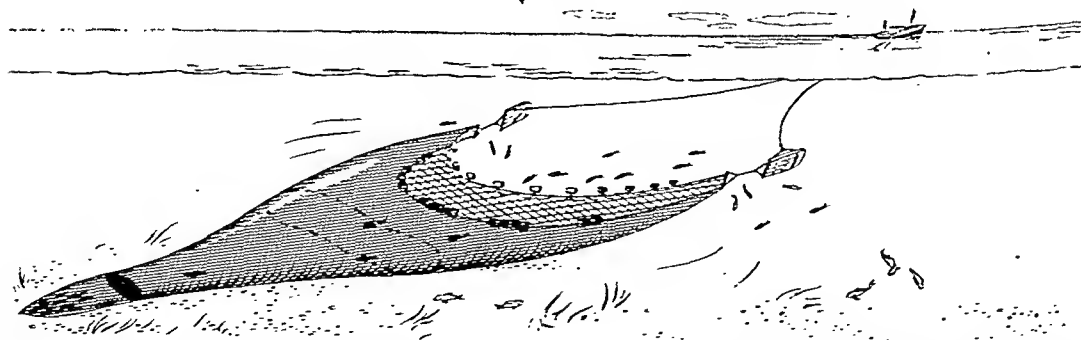
bottom of the net is closed. Portions of the net are then taken aboard the vessel until the fish are confined to a small area. The fish are scooped out with a power-operated dip net, or trawl.



THE NORTH ATLANTIC GILL NET

Gill nets are entangling nets placed in the path of moving fish, such as cod, haddock, and pollock. The head of the fish passes through the mesh of the net, but not the body. The gills catch

on the net and prevent the fish from hacking out. The picture shows how the net is supported at one end by the hoat, at the other by anchor and buoy. It is pulled in with a power winch.



THE ATLANTIC OTTER TRAWL

An otter trawl is a large conical bag of netting which is drawn over the ocean floor by a vessel known as a trawler or dragger. The mouth of the net is held open by buoys on the upper edge

and weights on the lower and by boards fastened to each side of the net. As the trawl is towed through the water the boards flare apart with the pressure of the water.

Only Japan leads the United States as a fishing nation. Other important fishing countries are the Soviet Union, Sweden, Norway, the United Kingdom, China, Canada, and Germany.

Marketing of Fish

The United States and Alaskan catch of fishery products is marketed fresh, frozen, canned or as fish meal and oil. Only about 2 per cent of the catch is salted or smoked. Since a large portion of the waste from filleting, canning, and otherwise preparing fish for market is used in the manufacture of meal and oil in addition to the whole fish used directly for this purpose, nearly half the total catch is reduced to meal and oil.

Changes in the marketing of sea foods have come about in recent years. One of the most important is the production of frozen fillets. Fillets are the sides of fish cut away from the backbone. They are practically boneless and have little or no waste. They are quick-frozen and packed with ice in insulated cartons for shipment.

An even more recent development has been the preparation of precooked and frozen fish and shellfish which need only to be heated to serve. Especially popular are "fish sticks," which first appeared in market tests in 1952. Production skyrocketed in 1953 from 115,000 pounds in January to nearly 3 million pounds in December.

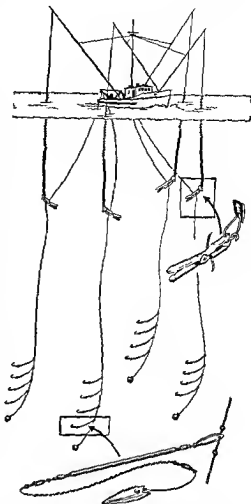
Fish sticks are cut from fillets in uniform sizes about three inches long and one inch wide. They are dipped in batter, breaded, and quick-cooked in hot fat. They are then frozen, packed, and shipped for distribution. The housewife needs only to heat them in the oven. They also can be eaten cold in picnic and school lunches and served cold as appetizers. They are made of whatever kind of fish is most abundant and hence are cheaper than other forms of fish.

Types of Fishing Gear

Over 85 per cent of the catch is taken with five types of gear—purse seines, otter trawls, hooks and lines, gill nets, and pound nets.

Nearly half the United States and Alaska catch is made in purse seines. The principal species taken by this method are menhaden, pilchard, herring, mackerel, and tuna. Other trawls and gill nets are used to take ocean perch, haddock, cod, flounder, pollock, whiting, and shrimp.

Many fish are taken by hook and line, principally tuna, halibut, salmon, and crabs. The gear usually consists of a line to which is attached one or more baited hooks. The lines may be hung in the water, laid on the ocean floor, or towed through the water behind moving fishing boats. Another variation in gear consists of the pole and short line with feathered lure and barbless hook that is used to catch tuna. The fish are attracted to the fishing vessel with live bait, which is carried in bait tanks and cast into the water near the stern of the vessel when schools of tuna are found.



PACIFIC COAST SALMON TROLLING

Many Pacific coast salmon are caught with moving line and bait. The trolling boats usually carry four poles, two of them as long as the boat (30 to 60 feet) and two shorter poles. The lines are of steel or bronze twisted wire. Various baits and lures are used—or metal spoons and wooden and plastic plugs or herring. The stabilizer reduces the roll of the boat.

Pound nets lead migrating fish into a maze from which they are unable to escape. Salmon, alewife, and menhaden are taken in this way.

Most modern fishing vessels locate schools of fish by means of an electronic device, the echo sounder. A school shows its shadow on a screen or is recorded on a moving roll of paper with a stylus. The crew does not lower the nets until the ship is over the school.

Research of Fishery Resources

In a world of steadily increasing population, millions of people are undernourished. Fish are among the best sources of body-building proteins. Yet in the United States the average annual consumption of fish

IMPORTANT FOOD, SPORT, AND COMMERCIAL FISHES OF THE WORLD

Name	Description	Habits	Remarks
Bass (fresh-water)	A sport fish with rather elongated body, greenish with darker markings; average size, 2 or 3 lbs.	Largemouthed bass lives mostly in lakes and sluggish streams; smallmouthed bass lives mostly in streams and cold lakes.	Considering its small size, many regard it as the gamest fish that swims.
Bass, Striped, or Rockfish (salt-water)	Greenish brown, sides golden silvery with narrow black stripes; average size, 4 or 5 lbs.; record, 125 lbs.	Lives in shallow waters in sea; ascends rivers to spawn, prepares nests, and takes great care of young.	Important commercially and affords excellent sport to angler. Introduced from the Atlantic into the Pacific.
Bluefish	A salt-water fish; bluish or greenish above and silvery below; weighs up to 27 lbs.; commonly attains weight of 10 lbs.	A warm-water species. Migrates up and down Atlantic coast from Florida to Massachusetts. Abundance fluctuates widely.	An excellent food and highly prized sport fish. Taken largely with gill nets, pound nets, and hook and line.
Carp	Fresh-water rough fish with greenish gray body; weighs up to 40 lbs. or more.	Feeds on plants, shellfish, insect larvae, and crustaceans. Hardy and can stand a wide range of temperatures.	Introduced into the United States from Europe in 1876. A native of China. Frequently held in tanks and sold alive.
Catfish	Primarily a fresh-water fish with smooth, scaleless skin, and barbels (whiskers) about the mouth. A relative of the carp.	Many species the world over. Abounds in brooks, lakes and ponds. The parents guard their eggs and young.	Hardy fish, much sought by anglers, supporting the most valuable commercial fishery of the Mississippi River and its tributaries.
Cod	Sea fish with a barbel under the jaw, 3 separate dorsal fins, 2 anal fins, a heavy body, large head, and a pale lateral line; average size, 10 lbs.; record, 211½ lbs.	Omnivorous; abounds along northern coasts of Europe and Atlantic and Pacific coasts of United States and Canada.	One of the world's chief food fishes and a rich source of liver oil for vitamins. More cod have been taken off the coast of North America than any other species.
Haddock	A close relative of the cod. Has a black lateral line; average weight, 2 to 4 lbs.; record, 15 lbs.	Lives deeper than cod and remains closer to bottom. Prefers bottom composed of smooth, hard sand, gravel, pebbles, or shells.	A valuable food fish. Most of the catch is filleted. Finnan haddock is smoked haddock fillets.
Halibut	The largest of the flatfish. Both eyes on same side of head; dark above, whitish below; average weight, 25 to 75 lbs.; known to reach 700 lbs.	Occurs in the North Pacific, North Atlantic, and Arctic oceans. Reaches commercial size at 5 years; matures at 12; some live 50 years.	Flesh keeps well and freezes well; hence halibut are available throughout the year. Pacific fishery an outstanding example of good conservation practices.
Herring	Small sea fish found in nearly all temperate waters of the Northern Hemisphere. Blue-green above, silvery white below; average length, 12 in.	Schools in vast numbers near the surface. Comes into shallow water to spawn. Eggs adhere to weeds, stones, or shells.	One of the world's most important food fishes. Also manufactured into fish meal and oil. Herring serve as food for many other species of fish.
Jack Mackerel	A member of the jack family, not related to the true mackerel. A small fish; record size, 22 in. long; weighs 4 lbs.	Occurs from northern California into Mexican waters. A schooling fish, often found with Pacific mackerel or pilchard.	Not important commercially until 1947. Catch now averages over 100 million lbs. a year. Almost all is canned.
Mackerel	A perfectly proportioned sea fish. Bluish or green with wavy black stripes above, silvery below; varies in length from 10 to 20 in., in weight from ½ to 3 lbs.	Atlantic and Pacific oceans. Travels near the surface in great schools. Year to year variations in catch partly due to variations in size of broods.	Atlantic catch used principally fresh and frozen. Nearly all the Pacific catch is canned.
Menhaden	A member of the herring family. At least three species occur off the Atlantic coast. Average size, less than a foot.	Migratory sea fish which travels in vast schools. Feeds entirely on plankton. Eggs float in the sea.	Taken in greater volume by United States fishermen than any other species. Used almost entirely for manufacture into meal and oil.
Mullet	Largely tropical fish of world-wide distribution. Closely related to the barracuda.	Lives in coastal waters and often runs into brackish river mouths to feed. Can be raised in ponds.	About three fourths of the United States catch is taken in Florida, chiefly on the west coast. Marketed mostly fresh and frozen.

IMPORTANT FOOD, SPORT, AND COMMERCIAL FISHES OF THE WORLD—Cont'd

Name	Description	Habits	Remarks
Ocean Perch or Rosefish	A brilliantly colored bottom fish found in the North Atlantic Ocean. Vivid orange or red above, paler underparts and large black eyes. In eastern Atlantic and Arctic, reaches a length of 3 ft.	Eggs develop and hatch within the body of the mother. The fish apparently rises off the bottom at night as it can be taken with trawls only during the hours of daylight.	This fish has been taken commercially in the United States only since 1934. Now the principal food fish taken by Atlantic coast fishermen. Entire catch is filleted.
Perch	Family of about 125 fresh water species. Color varies from yellow to blue. Slender body 8 to 12 in long weighs 1 lb or less.	Abounds in streams and lakes of Northern Hemisphere.	All varieties rank high as food. Bought commercially and for sport. Flesh very sweet and appetizing.
Pike and Pickerel	Soft-rayed smooth scaled fresh water fish bluish or grayish with yellowish white spots, slender and long snouted.	Found in rivers and fresh water lakes of northern Europe and North America. Unusual appetites and fighting qualities.	Attractive to sportsmen because of gameness and fighting strength. Pickerel means literally a little pike.
Pilchard	The true sardine belonging to the herring family. Dark green to blue above, silvery below. About 14 in long.	Found in great schools on Pacific coast from Alaska to Gulf of California. Numbers vary greatly from year to year.	Used for canning and for reduction into meal and oil. Record catch of 1½ bill on lbs landed in one year.
Pollock	A member of the cod family. Average length 2 to 3 ft. weight 4 to 12 lbs. record weight 35 lbs.	Fierce aggressive fish of the Atlantic and Pacific coastal waters. It prefers shallow waters.	Often called Boston bluefish. Has become more important in recent years due to increase in the sale of fillets.
Salmon Pacific	Large fish of the northern Pacific. Five kinds in eastern Pacific—chinook, chum, pink, silver and red. A sixth the masu found only on the Asiatic side. The chinook is the largest, ranging up to 110 lbs.	Spawns in fresh water streams and lakes and then dies. After hatching the young spend a period in fresh water and then go to sea, returning usually in 2 to 5 years depending on the species.	Is the basis of the world's most important canned fish industry. The loss of spawning grounds through advancing civilization threatens the future of this great industry.
Shad	A member of the herring family. Deep bluish above, silvery below. Length to about 20 in.	Lives along Atlantic from Canada to Florida. Spawns in rivers and streams. It migrates to salt water as young fish.	Introduced into Pacific coast in 1871 and now abundant there. Both the flesh and roe are canned.
Smelt	Small fish related to the salmon. Silvery in color, length about 12 in.	Occurs chiefly along Atlantic coast from Gulf of St. Lawrence to Virginia and in various northern lakes.	Prized as food because of delicate flavor. Enters streams to spawn when it is taken in great numbers.
Sturgeon	Large salt- and fresh water fish with slender elongated body covered with bony plates. Large specimens 10 ft long weighing 500 lbs.	Inhabits fresh waters and seas of North Temperate zone. Sea species return to streams to spawn. Food consists of small animals sucked into the mouth.	Prized as a food fish. Marketed fresh, smoked and canned. Eggs used in the preparation of caviar. Supply in most areas declining because of overfishing.
Swordfish	Identified by the prolonged upper jaw. With the tuna and the shark the swordfish ranks as the largest fish in the sea. Length up to 15 ft. weight over 1,000 lbs.	Found in warm and temperate seas throughout the world. Believed to obtain food by rising in the midst of schooling fish and attacking the smaller fish with its sword.	A scarce but highly valued food fish. Taken with harpoons while drifting lazily at the surface on calm sunny days.
Trout	Fresh water fish related to the salmon. Includes large lake trout and smaller brook trout of several species.	Lives in cold clear streams or lakes with gravelly bottoms. Gamey and will take many kinds of lures and bait.	Important food and sport fish much sought by anglers. Season is strictly limited by law.
Tuna	Large salt-water fish, member of the mackerel family. Widely distributed in temperate to tropical waters. Species taken by United States fishermen are the albacore, bluefin, little skipjack and yellowfin.	Inhabits the open sea, not limited to the continental shelf. Migrates great distances. Usually travels in large schools, permitting its capture by purse seines and live bait.	One of the world's greatest food reserves. World catch over 1 billion lbs a year and a considerable further increase believed possible. Japan, the United States and Peru are leading tuna fishing nations.
Whitefish	Fresh water fish of the salmon family, especially the whitefish of the Great Lakes. White or pale-colored flesh. Maximum weight about 23 lbs.	Inhabits lakes of Northern Hemisphere. Occurs in deeper parts of lake in summer, migrates to shallow waters to spawn in fall and winter.	A choice food fish. Marketed fresh, frozen and smoked. Major portions of the United States requirements imported from Canada.

per person is only 11 pounds. The Japanese eat about 80 pounds of fish a year, the Scandinavians from 40 to 50, and the English about 35. India has a per capita consumption of only 3 pounds of fish a year.

How to persuade people to eat more fish and new kinds of fish is a major problem of scientists all over the world. About 20,000 different kinds of fish have been identified, but fewer than 50 are marketed in any abundance. Fishermen once threw rosefish back into the sea. Now more than 250 million pounds are sold every year under the name of "ocean perch." Countless other species will eventually be accepted by the public.

The first effort to develop oceanic resources on a world-wide scale has been undertaken by the Food and Agriculture Organization (FAO) of the United Nations. It is charting a fish map of the oceans showing all the fisheries now in use and those not in use that promise results.

Fish that live close to the surface of the sea give us some idea of their numbers and kinds. We still know very little of those that dwell in the deeps.

FISHING—*The WORLD'S Most Popular SPORT*

FISHING. Catching fish from the ocean, lakes, or streams is not only the most popular but probably the oldest pastime pursued by man. Thousands of years ago men caught fish in nets and traps woven out of vines. They also fashioned hooks from bone, stone, and thorns and baited them with worms, grubs, or insects. The term "fishing" applies to the act of catching a fish from its natural home, the water. Taking fish with nets and seines for food is called "commercial fishing"; with hook and line for fun, it is called "sport fishing." (See also Fish; Fisheries.)

More than 17½ million people buy licenses every year in the United States and its territories for the privilege of fishing for fun. An estimated 10 million more people go fishing legally without a license. State laws vary in setting minimum age limits required for licenses, and in all United States coastal waters except off California, no license is required. Fishermen spend more than a billion dollars a year to pursue the sport—more than what the entire American public spends to attend all the football, baseball, basketball, hockey, horse racing, and other spectator sports events put together.

Fishing is such a popular sport because anyone can engage in it, regardless of age, sex, or income. Fishing can be enjoyed from childhood to old age with little more investment than a cane pole and a few hooks. Within an hour from the home of nearly everyone in the United States, no matter where he lives, is a place to fish. Girls can and do become just as expert at fishing as boys. In fact, every member of the family can learn to enjoy it individually or together.

Perhaps the greatest appeals in fishing for fun are the opportunities it offers to get out of doors, to enjoy the companionship of friends, to learn interesting facts about nature, and to use new and varied

What, for example, is the mysterious "scattering layer"? During World War II scientists using electronic sounding devices discovered layers of moving objects that cover hundreds of square miles. In the daylight hours they lie far below the surface; at night they rise. Whether they consist of fish or plankton, they are probably edible.

Scientists are also trying to find more effective fishing methods. The electronic echo sounder has increased catches wherever it is used. Some day it may be possible to fish with electric currents. In the path of an electric current flowing between positive and negative poles, a fish points toward the positive pole. By regulating the voltage, the fish can be forced to swim into a net. Large fish can be separated from small ones with stronger or weaker currents.

It is improbable that the seas can ever be "fished out." Some species may decline in numbers, however, and a world-wide program of ocean management may be necessary. The United Nations Indo-Pacific Fisheries Council to study fishing controls is a start (See also Fish; Fish Culture; Fishing.)

skills to outwit the fish. These mean far more to the good fisherman than bringing home a basketful of fish to eat; for if food was all that mattered it would cost him far less effort and money to buy his fish at the local market.

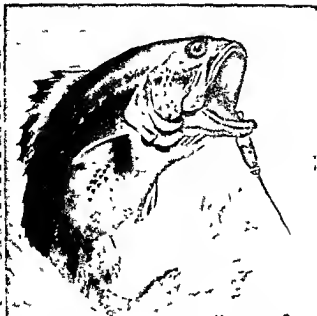
Many state, federal, and private organizations spend millions of dollars annually to keep a plentiful supply of fish available for sportsmen to catch. These include the state conservation departments of all the states and the territories, the United States Fish and Wildlife Service, the Sport Fishing Institute, and the Izaak Walton League.

In fishing as in any other sport, a set of ethics exists based on consideration for other sportsmen. One rule is to take no more fish than one needs. Some of the best fishermen catch their fish for the sport of it, then release them unharmed for someone else to catch again. A big string of fish does not necessarily show that a man is a good fisherman. A common term applied to a person who catches all the fish he can is "fish hog." The sporting methods a man uses in catching his fish and the consideration he displays for others he encounters while fishing are the marks distinguishing a true fisherman.

There are five basic techniques used to catch fish for fun: *still fishing*, *bait casting*, *fly fishing*, *trotting*, and *spinning*. Many variations of each technique can be used, depending on weather and water conditions, the type of fish sought, and the season of the year. A wide range of equipment can be used in each for the same reasons. The potential fisherman may select whichever method and whatever type of equipment suits his needs, desires, and pocketbook.

Still Fishing

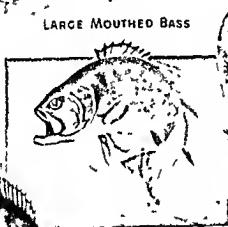
The term "still fishing" refers to the technique of catching fish without moving from one spot—an



LARGE MOUTHED BASS



RAINBOW TROUT



SMALL MOUTHED BASS



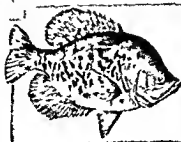
BROOK TROUT



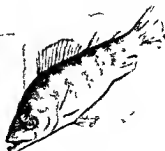
ROCK BASS



BLUEGILL



BLACK CRAPPIE

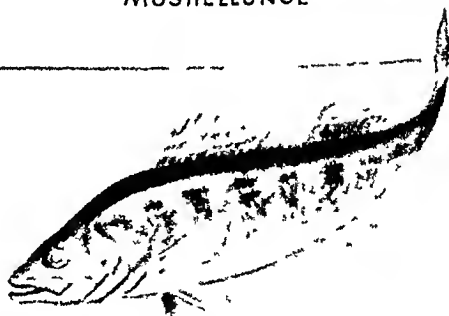
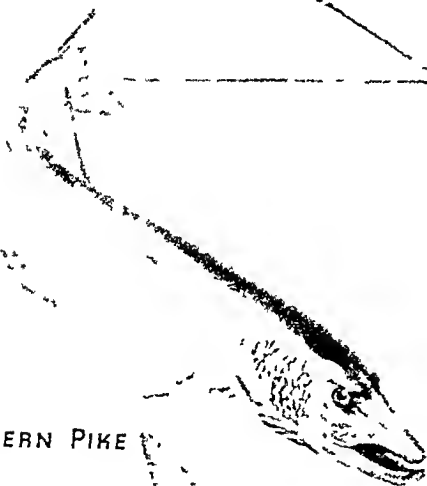


YELLOW PERCH



MUSKELLUNGE

NORTHERN PIKE

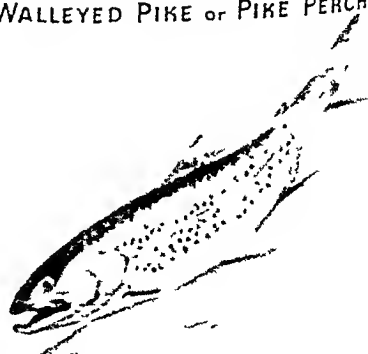


WALLEYED PIKE or PIKE PERCH



LAKE TROUT

CHINOOK SALMON



STEELHEAD TROUT

anchored boat a lrdge a dock or a bank. It is perhaps the most common method follo el Because the fisherman waits for the fish to come to his bait more patience is required in this technique than in any other. At the same time it is one of the most

A CANE POLE AND THE VARIOUS RODS

CANE POLE

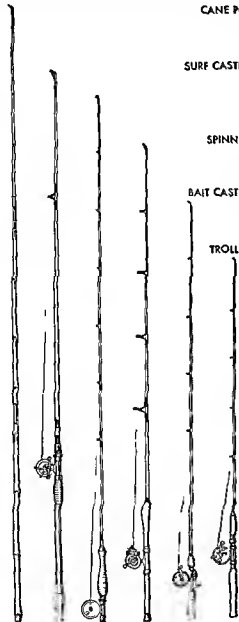
SURF CASTING

FLY

SPINNING

BAIT CASTING

TROLLING



Each of these rods is characterized by a different length and degree of flexibility. The cane pole shown here is about ten feet long; the rods are proportionately smaller. Small variations in rod lengths are matters of individual preference.

delightful and relaxing methods of fishing because it offers the fisherman an opportunity to enjoy the outdoor scene around him, visit with a companion or nap in the shade of a tree along the bank and still be fishing.

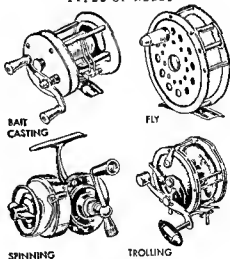
Fish commonly caught by the still fishing method in fresh water are hulfheads and catfish, sunfish, yellow perch, walleyed pike and crappies in salt water flounders, sea bass, drum and a host of others. While any of the more elaborate rod and reel combinations can be used in still fishing, the most common is the cane pole, a few feet of green cotton line, called *hand line*, a cork bobber and a single hook baited with worms or small minnows. Cane poles are the cured stalks of bamboo 8 to 12 feet long, available in most hardware stores. An even simpler pole can be cut in the woods from a green sapling.

A piece of cork, sometimes painted different colors and called a *bobber*, is strung on the line and held at the desired place by a wooden jam plug or a tension spring. The bobber floats on top of the water, holding the baited hook at any desired depth. When a fish bites the bobber bobs and gives the sign for the fisherman to lift his pole quickly or "set the hook" as it is called.

The hook, basic in all types of fishing, is made from tempered steel wire with a barb on one end. Once hooked, a fish has difficulty in pulling free. There are many shapes and sizes of hooks. The larger the number applied to it, the smaller the hook. A No. 6 or No. 8 hook with a long shank is commonly used in still fishing for pan fish such as perch, sunfish and crappies.

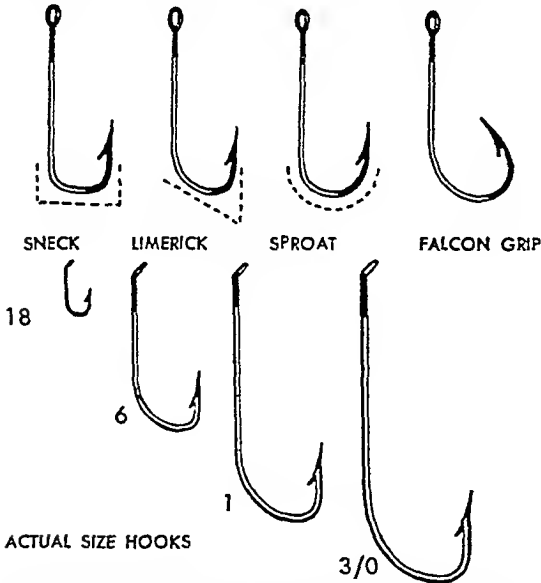
Sinkers are soft lead weights attached to the line to carry the bait down in the water. They are of

TYPES OF REELS

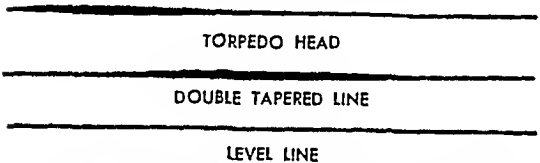


Dozens of different sizes and shapes of metal reels have been developed for the modern angler. All of them stem from the four basic types shown here. Each reel is suited to the particular fishing technique from which it gets its name.

HOOKS, LINES, AND LIVE BAITS



The fishhooks shown in the top row are some of the many types used in the various fishing methods. The hooks in the bottom row are of actual size. Sizes are designated by the numbers.

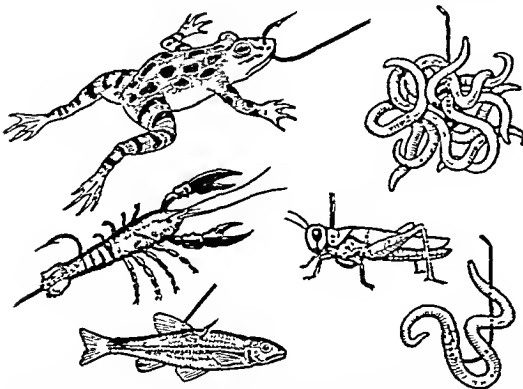


Torpedo head, double tapered, level, and other fly lines are designed for different weights and sizes of fly rods.

SIZE H—.025" DIAMETER

SIZE A—.060" DIAMETER

Diameters of fly lines are graded in size alphabetically from A to I, varying .005 inch for each letter. The thickest and next to the thinnest lines are shown here.



Common live baits and methods of hooking them are pictured here. A large "gob" of several worms is often used for bass and walleyed pike. A single worm is best for pan fish and trout.

three types: *split shot*, *pinch-on*, and *dipsy*. Each type comes in assorted weights and sizes. A split shot is simply a round ball of lead partially split open. It can be squeezed on to the line with the fingers. A pinch-on sinker is oblong in shape. It has a groove down the middle in which the line rests and a flap at either end which is pinched over, holding it in place. A dipsy sinker has a small wire ring embedded in one end through which the line is allowed to run free. It is used principally in still fishing for catfish.

A wide variety of small animals are eaten by fish and are used in still fishing. They are called "live bait." The most common are worms, minnows, frogs, crayfish, and assorted insects, from grasshoppers to cockroaches. Each is impaled on the hook in a different way, and where possible in such manner as to permit natural action and thus appear more attractive to the fish. "Night crawlers," popular as bait in still fishing, are large earthworms which come out of their holes at night on lawns and can be collected with a flashlight and a quick hand.

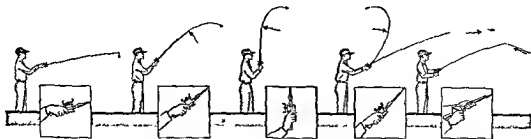
The most important factors for success in still fishing are locating the fish and fishing at the right depth. Since pan fish are most commonly sought with this technique, the still fisherman tries his luck along the edge of submerged weed beds, lily pads, brush piles, or docks in both lakes and slow-moving streams. Nearly any unpolluted small country stream is the home of bullheads, and often sunfish and perch as well. In such waters, the fish like the deeper pools or "holes." The best method is to send the bait close to the bottom and watch the bobber carefully for the slightest unnatural movement. It will often be nothing more than a slight wiggle. When this happens, the pole is raised sharply to set the hook in the fish's mouth. Then the fish is hoisted out of the water. Care should be taken not to disturb the water more than necessary. Most of the pan fish caught by this method travel in schools, and where one is caught others are likely to be nearby and should not be frightened away.

Patience is a prime requirement for the successful still fisherman. He can rest assured that if there are any fish in the water at all and he is using the right bait, properly presented, sooner or later a hungry one will swim by and take a bite. The alert fisherman watching his bobber knows when this happens and is ready for action.

Bait Casting

With the invention of a reel on which a considerable length of line could be wound, fishermen no longer found it necessary to use a very long pole to place bait some distance away. A shorter and stiffer pole, or rod, made it possible for him to "cast" his bait to a spot of his choice. In this way the technique of bait casting came into being. The bait, or lure, heavy enough to pull the line behind it off a reel, is propelled through the air to a desired spot. Bait casting is a very popular fishing technique used to catch a large variety of fresh- and salt-water fish.

HOW TO BAIT CAST



With the wrist turned so that the reel handle is on top, "aim" rod at target. Hold thumb lightly on the spool. Then, using only the wrist, bring rod back until it is straight up and down. When rod is vertical, but still moving back, push hand and wrist for-

ward and down. This causes rod handle to move forward and develop the "bow" which whips out the bait or plug. As forward motion is started, ease thumb pressure on spool. When bait has reached target, stop spool, shift rod to left hand and reel in.

A bait-casting rod is generally five to six feet in length and is made of solid or tubular steel split bamboo, or glass fibers molded into a tube. Affixed to it are three or four round metal rings called guides, through which the line passes. Just ahead of the cork handle of the rod is the seat for the bait-casting reel. Because of its gear ratio, this reel is sometimes called a "quadruple-multiplying reel." A bait-casting reel holds up to 200 yards of silk or nylon line. It has a level wind mechanism which lays the line evenly on the reel spool when it is wound up.

The size of the bait-casting line is measured in "test" figures from 6-pound test to 30-pound test. The figure refers to the weight which the line will support without breaking. Because of the flexibility of the rods, however, it is often possible to catch fish of much heavier weight than the line test used.

Many types of live bait and a thousand different types of artificial lures may be cast with a bait-casting rod and reel. Of the lures, plugs made out of wood or plastic into many different shapes and sizes are the most common. Most often they are fashioned to resemble some type of live bait such as a minnow, crayfish, or frog. Lures known as spoons are made with shiny silver, copper or bronze finishes. These

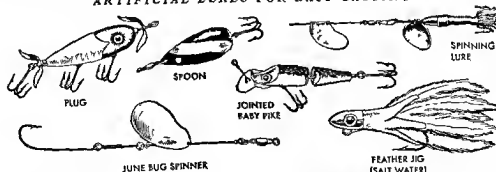
wobble and flash when pulled through the water. There are diving (weighted) plugs for fishing in deep water, light wiggling plugs for splashing along the surface feathered plugs and shiny metal spoons and weighted spinners with colored deer hair and rubber legs attached to them. There are plugs made from actual small minnows embedded in transparent plastic and a host of other variations. Many have triple "gangs" of hooks hanging from the middle and rear.

A small spring metal device similar to a safety pin and known as a swivel, is tied to the end of the line. The swivel makes it easy to change lures in bait casting and prevents the line from twisting as it is pulled through the water.

One common bait-casting error fishermen try to avoid is allowing the spool of the reel to unwind faster than the line is pulled out through the guides by the bait or the plug. This action results in a tangle of line on the reel known as a backlash or a bird's nest. It can be avoided by applying a slight pressure to the rotating spool with the thumb. Many modern bait-casting reels have screws to adjust spool tension to conform to the weight of the lure being cast and thus help avoid backlashes.

Depending on the type of lure used, the basic bait-casting technique is to cast the lure into spots

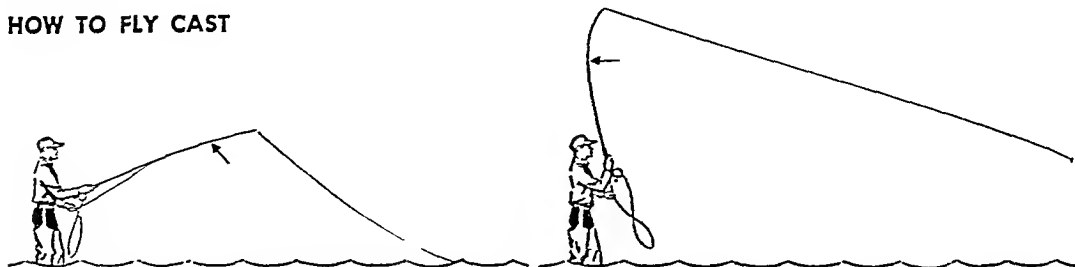
ARTIFICIAL LURES FOR BAIT CASTING



Among the thousands of different artificial lures for bait casting, these are common types. The sinkers have two or three sets of triple hooks. The shiny metal and brightly painted spoons

wobble and flash when pulled through the water. The weighted spinners have shiny metal blades which revolve. Spinning lures are light and salt-water lures are frequently larger.

HOW TO FLY CAST



The pictures in this two-page panel show the main steps in fly casting. Begin by stripping out 20 to 30 feet of line in front of you. Holding another ten feet loosely coiled in left hand, grasp rod

in right hand, thumb on top, reel below and parallel to the water. Keeping wrist and forearm straight, bend arm at elbow and start rod back at steady speed, picking line up from

where fish are likely to be. As soon as the lure hits the water, the line is retrieved by winding in on the reel handle. The act of a fish taking the lure in his mouth is known as the *strike*. In bait casting the fisherman sets the hooks immediately by jerking sharply upward on the rod. To get the most fun from the sport the good fisherman takes his time and "plays" the fish, allowing it to take line out as it wishes, reeling in line as the fish tires, and keeping a tight line at all times. In this way, he is able to bring in large fish without breaking his line or his rod.

Bait casting is used successfully for many fresh-water lake fish, principally muskellunge ("muskies"), walleyed pike, northern pike, large and small mouth bass, and some salt-water game fish, such as bonefish, wahoo, grouper, sea bass, snook, and barracuda. A bait-casting rod and reel may be used as well for still fishing or trolling.

Surf Casting

Surf casting is a specialized form of bait casting, developed for salt-water fishing. Special surf-casting rods and reels are used to enable the surf fisherman, who wades in the ocean from shore, to heave his lure out over the pounding surf. A typical surf rod is eight and a half to nine feet long over all, with a 30-inch butt, or grip. Both hands are used in casting with such a rod.

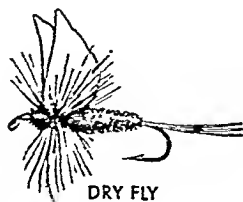
Surf-casting reels have "star drag" and "free spooling" mechanisms which enable a fish to take out line at the same time that the fisherman is reeling in. Tension, or drag, on the spool is set by means of the star-shaped nut underneath the reel handle.

Fly Fishing

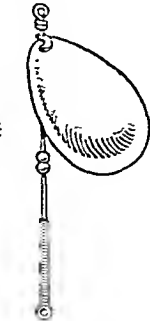
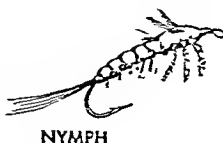
The term "fly fishing" refers to a technique of fishing with special, elaborately disguised hooks. On these hooks are wound fur, feathers, silk, and hair in different shapes and sizes to imitate a number and variety of insects, minnows, frogs, and even mice. It is one of the most popular methods of catching fish. It was originally introduced into the United States about 1875 from England where the method had been developed for catching trout and salmon. Fly fishing has become a popular technique for catching not only trout, but pan fish, bass, and, in recent years, many kinds of salt-water fishes such as bonefish, tarpon, snook, ladyfish, redfish, and others.

A special rod, known as a *fly rod*, is used in this technique. It is characterized by its length—from seven and a half to nine feet—and its flexibility, which enables the fisherman to cast tiny artificial flies, often weighing less than $\frac{1}{64}$ ounce. Fly rods are made of split bamboo, tubular steel, or molded glass fibers. They generally are made in two or three sections which are fitted together by means

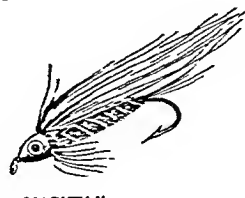
SOME COMMON FLY-ROD LURES



DRY FLY

INDIANA
SPINNER

NYMPH



BUCKTAIL



WET FLY



STREAMER FLY



POPPING BUG

Fly-rod lures are made from fur, feathers, hair, and silk and are tied on hooks to resemble minnows or insects. Wet flies sink below the water surface; these include the streamer flies, buck-

tails, and nymphs. Dry flies, such as the popping bug, float on the surface; these are often made of cork and feathers. Miniature pings, spoons, and spinners are also used as lures.



water. When rod is vertical, snap it back another foot to help rod tip pick up line. Hold rod firmly in this position until line unfolds behind you. Then bring arm and rod smartly forward to about

a 45° angle. As line unfolds in front of you it will pull on coil. Release coil and line will shoot out through rod guides. As this happens, lower rod to horizontal position to complete cast.

of interlocking metal tubes or *ferrules*. Of all types of rods, only on a fly rod is the reel always attached behind or below the grip.

A fly reel is a simple spool device without gears and is designed merely to hold the line. The common type is known as a *single-action* reel. The *automatic* reel has a spring mechanism which when released with the finger automatically winds up the line.

Fly lines are much thicker in diameter than bait-casting lines because in fly fishing the fisherman casts the line rather than the lure or bait. Fly line diameters are indicated by alphabetical symbols starting at A, the largest (.060 inch) and ending in I (.020 inch). Fly lines are braided from silk or nylon and given a smooth finish with oil so that they will shoot out easily through the metal guides fastened to the rod. They are usually 30 yards long. They may be the same diameter throughout (*level* line) or graded from a thicker diameter in the middle to a narrow diameter at one end (*single tapered*) or tapered toward both ends (*double tapered*). Sometimes a thick portion is built into a line near one end to give it more weight for casting heavier flies. Such a line is known as a *torpedo head* line.

Because most hooks used for artificial flies are too small to attach directly to a thick fly line and because such a heavy line is too easily seen by wary fish, fine *leaders* are used between the line and fly. These leaders are made either of the drawn intestines of the silkworm (called *gut*) or of nylon and are usually white or translucent. Leaders are either level or tapered, as are fly lines. They are available in 6, 7½, 9 and 12 foot lengths. Level leaders are used with bass bugs, large streamers or buck tails and larger flies. Tapered leaders are used with small dry and wet flies. Leader diameters are frequently referred to by numbers with an X after them; for example, a leader tapered to 1X would refer to one with an end diameter of .010 inch. The larger the number the smaller the taper—the smallest for practical use is 5X or .006 inch in diameter.

No one has ever listed all the different patterns of artificial flies used in fly fishing. There are probably at least 20,000 patterns, each tied differently and each with its own name, such as Jock Scott, Royal Coachman, Light Cahill, Bumblepuppy, Pale Evening Dun, Fuzzyesco, Rio Grande King, and

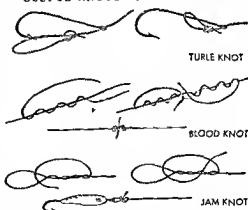
Queen of Waters. There are two basic types of artificial fly rod lures: dry flies, which float on the surface of the water and wet flies, which are maneuvered beneath the surface. Many are made to resemble natural food which fish eat. Those which do not resemble anything in nature as man sees it are still frequently taken by fish for food because of the action given them in or on the water by the fisherman.

Fly fishing is the accepted method of angling for trout in streams and is followed as well in rivers and lakes for large and small mouth bass and panfish. Presenting the fly to a fish quietly and in such fashion as to resemble natural insects is the most important factor for success in fly fishing.

Spinning

As a technique of fishing, spinning was practiced for many years in Europe but only achieved widespread popularity in the United States in the 1940's. The technique revolves around the reel so constructed that the line unwinds from the spool without any reel parts moving much as a sewing machine thread is taken off the end of its spool. Because friction is eliminated, it is possible in spinning to cast very light lures a long distance with ease and accuracy.

USEFUL KNOTS FOR FISHERMEN



Common knots favored by the fly and spin fishermen are the *turtle knot* and the *jam knot*, used for attaching hooks or lures to nylon or silkworm gut leaders. The *blood knot* (sometimes called the *barrel knot*) is useful for repairing breaks and for adding extensions, called *tippets*, to the leaders.

WHERE TO FISH IN STREAMS



A. In the shade of overhanging trees and bushes and undercut banks
B. In holes where tributary creeks come in

C. On downstream side of boulders or other obstructions
D. In fast water riffles below pools

E. In deep pools made by bends in stream
F. In white water at foot of waterfalls
G. Under bridges

As a method of fishing, spinning falls about midway between bait casting and fly casting in lightness of tackle used and thus in sport afforded the fisherman. All species of fresh- and salt-water fish commonly caught by either bait or fly casting can also be taken with spinning equipment and in many cases much more easily, since the fisherman need not approach his quarry as closely. He thus runs less risk of frightening the fish.

Spinning rods are made of split bamboo, tubular steel or copper, or hollow glass fibers. They average seven feet in length with a cork butt from 12 to 15 inches long. This long butt enables the fisherman to clamp his reel to the rod in a position to balance his equipment. Spinning-rod guides are larger than those on bait casting and fly rods and allow the line complete freedom of movement. The first guide nearest the butt is about one inch in diameter and is supported on legs well away from the rod.

Spinning lines are made of either braided or single strand (monofilament) nylon, graded in test weights like casting lines. Those commonly used range from 4- to 10-pound test. One hundred yards or more of such line can be wound on a spinning reel without crowding.

A large number of special lures have been developed for spinning. They resemble bait-casting lures such as plugs, spinners, and spoons, but they are smaller and lighter. A hollow plastic "bubble" filled with a desired amount of water for weight may be used

with spinning tackle. It is affixed to the line two to three feet ahead of the lure and enables the spin-fisherman to cast the lightest and tiniest artificial flies.

Spin casting differs from bait casting in the manipulation of the reel and line. To cast, the line is picked up by the tip of the index finger of the hand holding the rod. The *bail*, or *pick-up finger*, on the reel is put in casting position, so that the line is free to run off the spool without interference. When the line hits the water the fisherman begins to reel in (retrieve) his line. As soon as the retrieve is started, the bail automatically snaps into pick-up position to wind the line on the spool. Spinning reels, like surf-casting reels, permit a fish to run with the line while the angler is reeling in.

One advantage of spinning over bait casting is that the rod is held in position with the guides downward and the reel underneath. Thus a fisherman does not have to change hands to reel in his line, as the reel handle is in proper position. Spinning reels are available for both right- and left-handed casters.

The technique of hooking and playing a fish with a spinning outfit is similar to that used in bait casting. Because of its versatility, enabling the fisherman to cast light lures a considerable distance, spinning is a good all-around technique for a beginner and will take almost any fresh- or salt-water fish.

Trolling

"Trolling" is the term applied to a technique of fishing in which the bait or lure is towed through

WHERE TO FISH IN LAKES



A In shelter of boulders on rocky shore
B Under overhanging trees and bushes
C In deep water near center of lake

D Under docks and rafts
E At mouth of stream entering lake
F Near mouth of outlet stream

G Near dead logs and brush piles
H Along edges of shore line July pads
and weed beds

the water behind a moving boat. Because a large area of water can be covered it is a very successful method of taking fish when all others fail. Trolling from a motor launch or from a specially outfitted sport fishing vessel is particularly popular for big game ocean fish such as tuna or sword fish. In fresh water, cane poles, bait-casting tackle, fly rod and spinning outfits can be used to troll.

Special trolling rods, often called *boat rods*, are made for trolling in deeper or larger lakes for salmon, lake trout, muskellunge and large northern pike. These rods are heavier, stiffer and shorter than other rods because heavy weights and long lengths of line are frequently used and because a more lumber rod would cause many missed strikes. Fishermen troll with all lures commonly used in bait casting and spinning as well as with live bait.

Where to Fish a Lake

No matter what technique he uses a fisherman cannot catch fish unless he places his bait or artificial lure where the fish are. Observation and experience teach him the places where fish frequently feed, spawn or rest. Most fish like some sort of protection from their enemies or they are attracted to particular spots in a lake because the water temperature or food available is to their liking.

Most lakes and ponds have several such places where the hopeful angler may try his luck. The experienced angler fishing strange waters will seek out such spots. If he is unsuccessful there he will resort

to trolling systematically, testing his lure at different places and depths in an effort to find out where the fish are concentrated.

Where to Fish a Stream

As in lakes, fish in streams seek protected locations behind boulders or logs and spots where the current washes food to them. The successful fisherman concentrates on these places leaving flat stretches devoid of protective cover alone. Fish often move about in a stream for considerable distances and if not found in one of the habitual locations can frequently be found in another.

A beginning fisherman will find it advisable to consult a local resident tackle dealer or another fisherman who knows the stream for information on specific locations in that stream where the fish he seeks are likely to be found. Generally speaking the deeper pools where the stream bends or turns harbor the largest and the most fish.

Common Fishing Terms

Bucking extra line wound on a reel behind a fly box used in fly fishing.

Backlash snarl of line on reel common in bait casting.
Bobber cork float attached to line in still fishing movement indicates when a fish bites.

Bucktail artificial wet fly made from hair of a deer's tail.

Chum scattering ground up fish or other foods upon the water to attract fish.

Cree basket or bag suspended from the shoulder in which to carry fish.

Drag: movement of line across the water which gives the lure unnatural action in fly fishing.

Drop-off: place in a lake where shoal water near shore suddenly drops off to the depths.

Dropper: extra fly affixed to the leader ahead of the end, or "tail", fly.

Eddy: circulation of water in a moving stream in whirlpool fashion, which frequently concentrates food for fish.

Eyed fly: an artificial fly without a piece of leader already attached to it.

Forage fish: fish commonly eaten by other fish for food.

Foul-hooked: the hooking of a fish accidentally in any part of the body except the mouth.

Gaff: heavy metal hook used to lift large fish from the water.

Hair frog: imitation frog made from deer hair.

Hatch: emergence of natural insect life on the water.

Hook cast: a type of cast in fly fishing in which the lure hooks around interfering objects.

Hook shank: long straight part of the hook.

Landing net: cotton or linen net bag on a hoop used to lift hooked fish from the water.

Leader: nylon or gut extension attached to the end of the line in fly fishing.

Nymph: type of fly resembling underwater insect life.

Pan fish: type of fish most commonly sought for food rather than sport, such as sunfish, perch, and crappies.

Plug: wooden or plastic lure with hooks attached made to resemble a food attractive to fish.

Pool: deep portion of a stream commonly found at bends where bigger fish lie.

Reel seat: place where a reel is affixed to the rod.

Riffle: shallow portion of a stream, where water passes over sunken boulders or rocks.

Rise: activity of fish in feeding on a natural insect hatch.

Rollcast: type of cast developed in fly fishing where background obstructions prohibit a backcast.

Rough fish: type of fish not considered useful for food or sport.

Seine: cotton or twine net used to capture fish.

Sinker: lead weight which can be affixed to the line to carry the lure into deeper water.

Snag: hooked lure fouled on some obstruction.

Snelled fly: fly with a piece of leader already attached to it.

Spinner: shiny metal blade which revolves around a fine wire shank when pulled through the water and thus attracts fish.

Split shot: type of sinker in the shape of a sphere, with a split in the middle in which the line rests.

Spoon: a brightly polished metal lure.

Streamer: wet fly made from full chicken feathers to resemble a minnow.

Strike: action of a fish in taking a lure.

Taper: graduation in diameter of a line or leader from large to small.

Terminal tackle: part of fishing gear nearest the lure; for example, leaders.

Tippet: extension tied on to the end of leaders which have been broken off or used up.

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FITCH, JOHN (1743-1798). One of the early experimenters with the steamboat was John Fitch. He was born Jan. 21, 1743, in Windsor, Conn. A restless and versatile man, he was at various times sailor, clock-maker, brass founder, silversmith, surveyor, and map maker. During the American Revolution he was a sutler, following the army and selling goods to soldiers. As early as 1785 he petitioned several state legislatures for aid in building a steamboat, exhibiting a side-wheel model; but money was scarce.

In 1786 he formed a company and soon after launched on the Delaware a boat propelled by six mechanically driven paddles on each side. He continued to experiment. In 1790 his boat was put into regular service between Philadelphia, Pa., and Trenton, N. J. After a few months' operation, the vessel was wrecked and Fitch's backers refused further support. Eight years later, poor and embittered, Fitch took poison and died at Bardstown, Ky., on July 2, 1793.

Fiume (fyg'mā). On the eastern Adriatic coast 40 miles southeast of Trieste lies Fiume. It is a sunny easy-going city which one would never suspect of being the cause of international trouble. However, from the time it was captured by Charlemagne in 799, it has had a disturbed history and has shifted to various owners, going finally to Hungary, which developed it as its seaport. After the first World War Fiume threatened to become the cause of a new war between Italy and Yugoslavia. Both countries claimed it, Italy on the ground that the population of the city (excluding the suburb Susak) was strongly Italian, and Yugoslavia on the ground that geographically it was part of Croatia, one of the Yugoslav territories, and was that country's natural and necessary outlet to the sea.

In 1919 Gabriele d'Annunzio, flamboyant Italian poet and war hero, took direct action. With a brigade of troops and a small band of volunteers he seized Fiume. In 1920 the Treaty of Rapallo made Fiume independent, but d'Annunzio yielded only to force. In 1924 the Agreement of Rome gave Fiume to Italy and nearby Porto Barros to Yugoslavia. In 1944, in the second World War, Yugoslav and Russian troops seized Fiume. The Allied peace treaty of 1947 then gave it to Yugoslavia. Population, 72,130.

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PROUD and COLORFUL SYMBOLS of NATIONS

FLAGS Every nation adopts a special flag to represent its unity and independence. A nation's flag stands for the goals, hopes and ideals of its people. In its own land such a flag commands the honor and love of all its citizens; abroad it is respected as the emblem of a self-governing people.

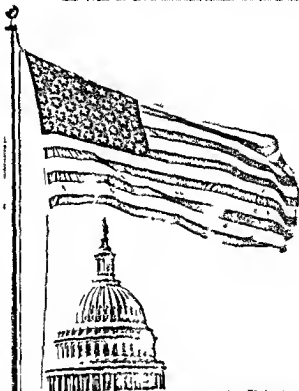
Most national flags show events or ideas of particular importance to the nation's people. For example, the sun in the flag of Argentina is for the revolution of 1810; the three crosses in the flag of the United Kingdom represent the union of England, Scotland and Ireland; and the crescent of Islam stands for the Mohammedan faith in such flags as those of Egypt and Pakistan. Colored illustrations of national flags begin on page 131.

Growth of the Stars and Stripes

The flag of the United States was created by Congress June 14, 1777. It consisted of 13 stars and 13 stripes representing the 13 colonies that had declared their independence the year before. Later Congress decided to add a new star and a new stripe for each state admitted to the Union. In 1795 this was done to give representation to Vermont and Kentucky. By 1817, however, there were 20 states in the Union and it became apparent that adding one stripe for each new state would destroy the shape of the flag. As a result, Congress restored the original design of 13 stripes and provided that each state was to be represented by one star.

There was no official manner of arranging the stars in the canton until 1912. In that year President Taft ordered that they should be placed in six even rows of eight stars each.

Flying majestically near the dome of the National Capitol in Washington, D.C., is the flag of the United States—the emblem of a free and independent people.



Because its creation dates back to 1777, the flag of the United States is the fifth oldest national flag in the world. (Older flags are those of Denmark, Switzerland, Sweden, and the Netherlands.) Before the adoption of the Stars and Stripes, many different and colorful emblems flew over the 13 original colonies. The most interesting and important of these historic flags are shown in color on page 129.

In addition to the national flag, the other government flags that fly in the United States are those of the federal departments and the states. These flags appear in color on pages 125 through 137.

Flags are also used to represent organizations such as the Boy Scouts and Girl Scouts, political alliances such as the North Atlantic Treaty Organization, and

DIFFERENT TYPES OF FLAGS

National—flag flown as the symbol of a nation.

Color—national flag carried by foot troops and by supreme commanders. Usually 44" by 56".

Standard—national flag carried by mechanized and motorized troops. Usually 3 by 4.

Ensign—flag flown by warships as a national symbol. (In the United States and certain other countries the national flag and the ensign are the same.)

Union Jack—flag usually consisting of the canton (or union) of the ensign. In most countries it is flown by government vessels in port.

VARIOUS PARTS OF A FLAG

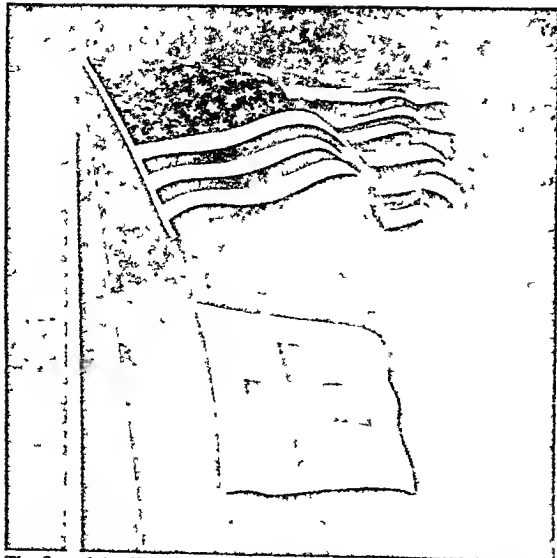
Canton or Union—upper corner nearest the staff. This is the point of honor in a flag. It is sometimes called the union, although the union may cover the entire flag as in the case of the United Kingdom.

Hoist—the height of the flag from top to bottom, or part closest to the staff.

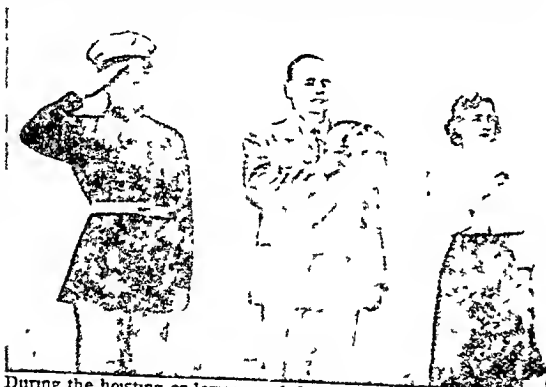
Fly—the length of the flag from staff to free end, or the outer part farthest from the staff.

Truck—a small cap of wood fixed on the head of a staff or mast.

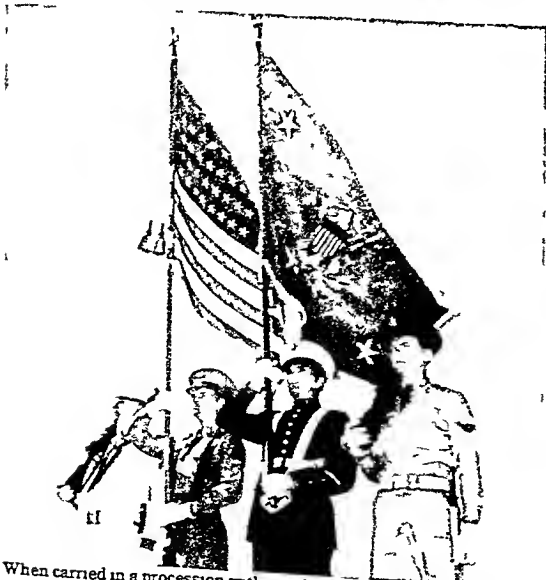
Field or Ground—the part of a flag outside the canton.



The flag of the United States should always fly above all subordinate flags (such as the Red Cross emblem) on the same halyard.

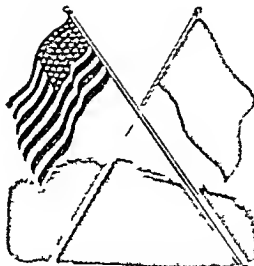


During the hoisting or lowering of the flag or when it passes in a parade, all persons present should salute as shown above.

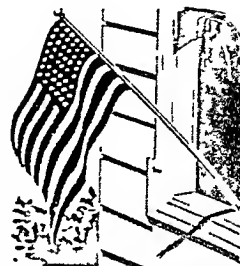


When carried in a procession with another flag, the Stars and Stripes should be on the marchers' right (the flag's own right).

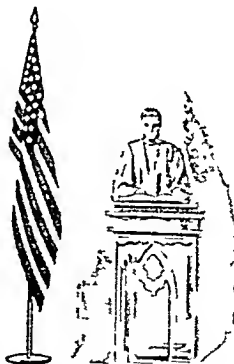
FLAG OF THE UNITED STATES



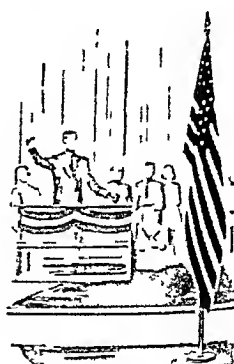
When displayed with another flag the Stars and Stripes is on its own right, its staff in front.



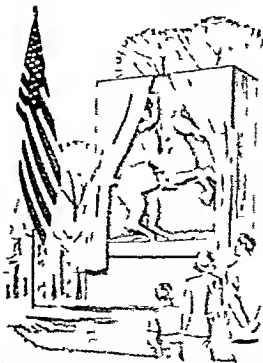
The flag should always be displayed so that its canton is at the peak of the flag staff.



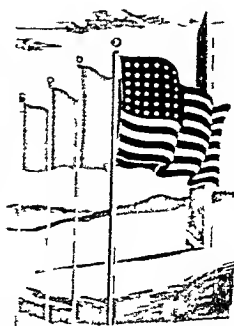
On a platform or in a chancel of a church the flag is displayed to the right of the speaker.



If the flag is displayed other than on a platform or in a chancel it is at the audience's right.



At the unveiling of a statue the flag should be displayed but should not be used as a cover.



In a group of national flags, the emblems should fly from separate staffs of the same height.

HOW TO HONOR AND DISPLAY IT



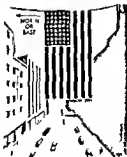
When displayed with subordinate emblems the flag should be slightly higher and centered



On a wall or window the canton of the flag should be uppermost and to the flag's own right



On a rostrum the flag should be behind and above the speaker or canton to flag's own right

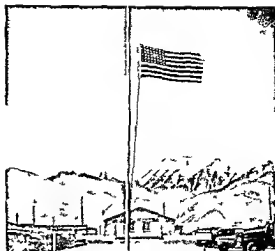


Suspended vertically over a street the canton of the flag is either to the north or east

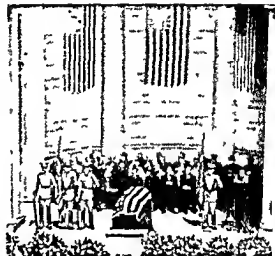


When taken down the flag should be carefully folded. The military fold is triangular

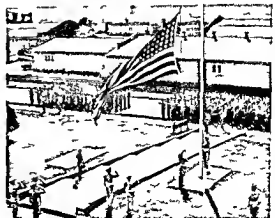
The triangular fold gives a compact triangle with only the hem and a few stars showing



Wherever the flag is displayed the half-staff position honors the nation's heroes and dead, such as on Memorial Day morning

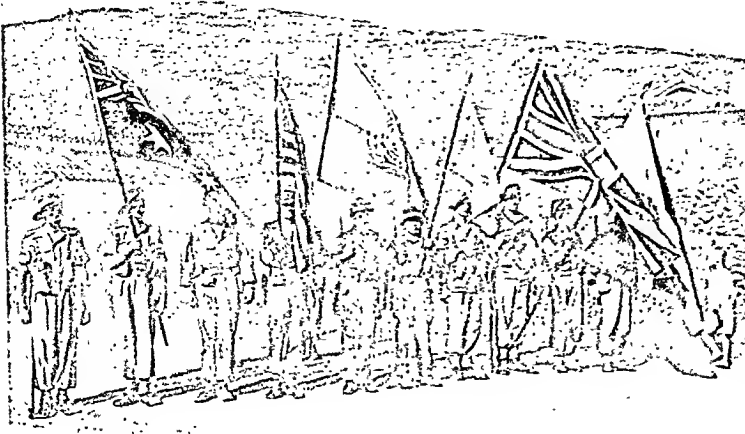


On a casket the flag should be placed so that the canton is at the head and over the left shoulder of the deceased



At retreat the flag is ceremoniously lowered as a bugler blows 'Retreat' or a band plays 'The Star Spangled Banner'

FIGHTING UNDER AN INTERNATIONAL FLAG



In 1950 troops from many nations began carrying the banner of the United Nations in the Korean war. The flags here represent (left to right) Australia, the United States, the United Nations, Republic of Korea, United Kingdom, and the Philippine Islands.

international bodies such as the United Nations and the Red Cross. Flags of special design are used as a method of communication (see Signaling).

Forerunners of Modern Flags

Since early times people have displayed various kinds of objects to show their nationality or their allegiances. The Aztecs carried fans made of green feathers from the quetzal bird; and the Assyrians bore disks with an image of a running bull on them. The first battle "flag" of ancient Rome was a mere wisp of straw tied on a pole.

One of the first true flags was the *rexillum* carried by Roman cavalry. It was a square piece of fringed cloth hung on a crossbar at the end of a spear. Europeans carried their flags in this manner until the Middle Ages when they saw invading Saracens flying flags attached at the side to a staff. This

method of display allowed a flag to flutter aloft as a rallying point for troops. The Romans originated the custom of hanging flags of victorious battles in their temples. This practice continued in Christian churches down to modern times.

Toward the end of the Middle Ages flags had become accepted symbols of nations, kings, organizations, cities, and guilds of workmen. Some of the guild flags bore obvious devices, such as the black flag with three white candles representing the candle-makers of Bayeux (France) or the crowned fishes on the fish-mongers' flag. The witty lawyers of Laval (France), had a blue banner bearing a device of three golden mouths. The flag of mercenaries, or fabric dealers, showed the Virgin drying her hair; the salters' banner displayed three boiled eggs, and the gardeners' flag portrayed Adam with a spade.

Flag Size, Material, and Design

In the age of chivalry, banners were square, then oblong, and for a time the size of the flag indicated the rank of the owner. Later flags became longer and narrower, more the proportion of the present flag of the United States.

Flag material is also changing with the times. Silk is still popular but many American flags today are made of nylon which wears longer than the thin woolen (or cotton) bunting formerly used.

Early flags usually followed the many and strict rules of heraldry (see Heraldry). Beginning in the late 1700's, however, and especially in the New World, such rules were freely disregarded at the often crucial moment of designing a new flag.

FAMOUS FIRSTS OF THE STARS AND STRIPES

MANY conflicting claims have been made for the first displays of the flag of the United States. Historians have sometimes confused the Cambridge, or Grand Union, flag with the Stars and Stripes that grew out of the flag resolution of June 14, 1777. The following is a list of first displays most commonly accepted for the flag established by Congress.

On a ship at sea—Nov. 1, 1777—the *Ranger*, commanded by John Paul Jones, sailing from Portsmouth, N. H.

In combat at sea—November 1777—en route to Nantes the *Ranger*, under John Paul Jones, captured two brigantines and sent them into French ports as prizes.

Outside the United States—Jan. 28, 1778—on Fort Nassau, Bahama Islands

In ground combat—Aug. 16, 1777—at battle of Bennington (Vt.). This was the so-called Bennington flag. The flag of the Third Maryland Regiment at the battle

of Cowpens (S. C.) Jan. 17, 1781, reflected more accurately the terms of the flag law of June 14, 1777.

Around the world—Sept. 30, 1787, to Aug. 10, 1790—carried by the *Columbia*, which sailed from Boston.

Over a schoolhouse—May 1812—at Colrain, Mass.

First Foreign Recognition

Feb. 14, 1778—a salute of nine guns from the French fleet in answer to a salute of 13 guns given by John Paul Jones as he entered Quiberon Bay near Brest, France.

April 24, 1778—John Paul Jones compelled a British man-of-war to strike its flag to American flag.

First Flag Days

June 14, 1861—observed first time at Hartford, Conn.

June 14, 1893—celebrated in public schools first time at Philadelphia.

Aug. 3, 1949—President Truman approved resolution designating June 14 annually as national Flag Day.

Flag of the United States—Its Code and Traditions

MANY traditions have grown up regarding the display and use of the United States flag. These traditions intended as marks of respect are widely observed. The Army, Navy and Air Force have their own regulations, but these do not apply outside the armed services. To supply a guide for the proper use and display of the flag a code was drawn up at a National Flag Conference held in Washington D C June 14-15 1923. This was revised by the Second National Flag Conference May 15 1924. Finally in June 1942 Congress adopted a resolution (amended December 1942) which made the flag code a law. The code contains these provisions:

1 The flag should be flown only from sunrise to sunset or between such hours as designated by proper authority. (The flag is flown day and night on the east and west fronts of the United States Capitol on the grave of Francis Scott Key at Mount Olivet Cemetery Frederick Md. at the War Memorial Worcester Mass. at Fort McHenry and at Flag House Square both in Baltimore Md.) It should be displayed on national and state holidays and on historic and special occasions. The flag should always be hoisted briskly and should be lowered slowly and ceremoniously.

2 When carried in a procession with other flags the flag of the United States should be either on the marching right—that is its own right or it may be in front of the center of the line of flags.

3 When displayed with another flag against a wall from crossed staffs the flag of the United States should be on the right its own right and its staff should be in front of the staff of the other flag.

4 When a number of flags are grouped and displayed from staffs the flag of the United States should be at the highest point or at the center or the first flag at the right of center.

5 When flags of states or of cities or pennants of societies are flown on the same halyard with the flag of the United States of America the national flag should always be at the peak. When flown from adjacent staffs the flag of the United States of America should be hoisted first and lowered last. No flag or pennant should be placed above or to the right of the flag of the United States of America.

6 When flags of two or more nations are displayed they should fly from separate staffs of the same height and the flags should be of approximately equal size. (International usage forbids the display of the flag of one nation above that of another nation in time of peace.)

7 When the flag is displayed from a staff projecting horizontally or at an angle from the window sill balcony or front of building the union of the flag should go clear to the peak of the staff unless the flag is at half staff. When it is to be suspended over a sidewalk from a rope extending from a house to a pole at the edge of the sidewalk the flag should be hoisted out un on first from the building.

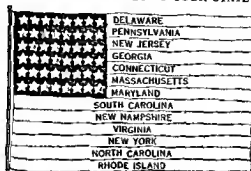
8 When the flag is displayed in a manner other than by being flown from a staff it should be displayed flat whether indoors or out or so suspended that its

folds fall free as if it were staffed. When displayed against a wall the union should be uppermost and to the flag's own right (observer's left). When displayed in a window the union or blue field should be to the left of the observer in the street.

9 When displayed over the middle of the street as between buildings the flag should be suspended vertically with the union to the north in an east and west street or to the east in a north and south street.

10 On a speaker's platform the flag if used flat should be placed above and behind the speaker. It

WHICH STAR BELONGS TO YOUR STATE?



There is no legal or other official authority for assigning the stars in the flag to certain states. There is, however, a popular wish to give each state a definite star according to the order in which it ratified the Constitution or entered the Union. With the stripes similarly assigned to the 13 original colonies. In the design above the stars are numbered as follows:

- | | |
|-------------------------------|-------------------------------|
| 1 Delaware Dec 7 1787 | 25 A Kansas June 15 1855 |
| 2 Pennsylvania Dec 12 1787 | 26 Michigan Jan 26 1837 |
| 3 New Jersey Dec 18 1787 | 27 Florida March 3 1845 |
| 4 Georgia Jan 2 1788 | 28 Texas Dec 29 1845 |
| 5 Connecticut Jan 9 1788 | 29 Iowa Dec 28 1846 |
| 6 Massachusetts Feb 6 1788 | 30 Wisconsin May 29 1848 |
| 7 Maryland April 28 1788 | 31 California Sept 9 1850 |
| 8 South Carolina May 23 1788 | 32 Minnesota May 11 1858 |
| 9 New Hampshire June 21 1788 | 33 Oregon Feb 14 1859 |
| 10 Virginia June 26 1788 | 34 Kansas Jan 29 1861 |
| 11 New York July 26 1788 | 35 West Virginia June 20 1863 |
| 12 North Carolina Nov 21 1789 | 36 Nevada Oct 31 1864 |
| 13 Rhode Island May 29 1790 | 37 Nebraska March 1 1867 |
| 14 Vermont March 4 1791 | 38 Colorado Aug 1 1876 |
| 15 Kentucky June 1 1792 | 39 North Dakota Nov 2 1889 |
| 16 Tennessee June 1 1796 | 40 South Dakota Nov 2 1889 |
| 17 Ohio March 1 1803 | 41 Montana Nov 8 1889 |
| 18 Louisiana April 30 1812 | 42 Washington July 11 1889 |
| 19 Indiana Dec 11 1816 | 43 Idaho July 3 1890 |
| 20 Missouri Sep 30 1820 | 44 Wyoming July 10 1890 |
| 21 Illinois Dec 3 1818 | 45 Utah Jan 4 1896 |
| 22 Alabama Dec 14 1819 | 46 Oklahoma Nov 16 1907 |
| 23 Maine March 15 1820 | 47 New Mexico Jan 6 1912 |
| 24 Missouri Aug 10 1821 | 48 Arizona Feb 14 1912 |

should never be used to cover the speaker's desk or to drape over the front of the platform. If flown from a staff it should be on the speaker's right.

11. The flag should be displayed at the unveiling of a statue or a monument but should not be used as a covering. Blue, red, and white bunting may be used as a drapery.

12. When flown at half-staff, the flag is hoisted to the peak for an instant, then lowered to the half-staff position (one-half the distance between the top and bottom of the staff). Before lowering the flag for the day it is raised again to the top. For some local conditions the flag may be flown at approximately half-staff. On Memorial Day, May 30, the flag is displayed at half-staff until noon and at full staff from noon until sunset. Half-staff honors the heroic dead; full staff shows that the nation lives and the flag is the symbol of the living nation.

13. Flags flown from fixed staffs are placed at half-staff to indicate mourning. Only by the order of the president may crepe streamers be affixed to flagstaffs or spearheads in a parade.

14. When used to cover a casket, the flag should be placed so that the union is at the head and over the left shoulder. The flag should not be lowered into the grave nor allowed to touch the ground. The casket should be carried foot first.

15. In the body of a church, the flag should be displayed from a staff at the right of the congregation as they face the clergyman. The service flag, the state flag, or other flag should be at the congregation's left. If in the chancel or on the platform, the flag should be placed at the clergyman's right and the other flags on his left.

16. When the flag is in such a condition that it is no longer a fitting emblem for display, it should be destroyed in a dignified way, preferably by burning.

Cautions Listed in Flag Code

1. Do not permit disrespect to be shown to the flag of the United States of America.

2. Do not dip the flag to any person or thing. The regimental color, state flag, organization flag, or institutional flag will render this honor.

3. Do not display the flag with the union down except as a signal of dire distress.

4. Do not place any other flag or pennant above or to the right of the flag. (The only exceptions are: at United Nations headquarters the United Nations flag flies above all others; at sea the church pennant flies above the flag during church services.)

5. Do not let the flag touch anything beneath it, such as the ground, water, floor, or merchandise.

6. Do not place on or above the flag, or place on any part of it, or attach to it any object or emblem of any kind or any mark, insignia, word, letter, figure, design, picture, or drawing.

7. Do not use the flag as drapery in any form whatever, but always allow it to fall free.

8. Do not fasten, display, use, or store the flag in such a way as will permit it to be easily torn, soiled, or otherwise damaged.

9. Do not drape the flag over the hood, top, sides, or back of a vehicle, train, or boat. To display the flag on a motorcar, fasten the staff firmly to the chassis or clamp it to the radiator cap.

10. Do not display the flag on a float in a parade except from a staff, or as follows: (a) flat or (b) so suspended that its folds fall free as though it were displayed from a staff.

11. Do not use the flag as a covering for a ceiling.

12. Do not carry the flag flat or horizontally but always as in a parade, aloft and free.

13. Do not use the flag as any portion of a costume or athletic uniform. Do not embroider it upon cushions or handkerchiefs and the like or print it upon paper napkins or boxes or anything that is intended for brief use and discard.

14. Do not use the flag in any form of advertising or fasten any advertising sign to the staff or halyard from which the flag is flown.

15. Do not use the flag for holding or carrying anything.

Proper Use of Bunting

Bunting of the national colors should be used for covering a speaker's desk, for draping over the front of a platform, and for decoration in general. Bunting should be arranged with the blue above, the white in the middle, and the red below.

Salute to the Flag

When the flag is passing in parade or in a review or is being hoisted or lowered all persons present should face the flag, stand at attention, and salute. Those in uniform should render the military salute. Men not in uniform should remove the hat with the right hand and hold the hat at the left shoulder, the hand being over the heart. Men without hats and women should salute by placing the right hand over the heart. Aliens should stand at attention. The salute to the flag in the moving column is rendered at the moment the flag passes.

When the national anthem is played and the flag is not displayed, all present should stand and face toward the music. Those in uniform should salute at the first note and retain this position until the last note. All others should stand at attention, the men removing their hats. When the flag is displayed, all should face it and salute. The President of the United States is empowered to alter any rule or custom pertaining to the use and display of the flag.

Salute When Giving the Pledge to the Flag

In pledging allegiance to the flag, stand with right hand over heart or merely at attention. Men remove their headdress. Persons in uniform give the military salute. All should pledge together:

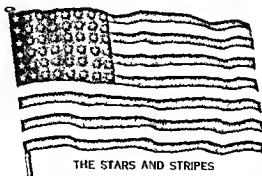
I pledge allegiance to the Flag of the United States of America and to the Republic for which it stands, one Nation under God, indivisible, with liberty and justice for all.

(This pledge was first published in 1892 at Boston, Mass. Authorship was claimed for two men, James B. Upham and Francis Bellamy. In 1939 a committee of the United States Flag Association ruled that Bellamy was the author of the original pledge.)

EMBLEMS *of the* UNITED STATES



PRES DENT



THE STARS AND STRIPES



SECRETARY OF TREASURY



V CE PRES DENT



SECRETARY OF DEFENSE



SECRETARY O STATE

GREAT
SEAL



UNITED
STATES



SECRETARY OF ARMY



SECRETARY O NAVY



SECRETARY O A R FORCE



MAR NE CORPS



ATTORNEY GENERA



POSTMASTER GENERAL



SECRETARY OF INTERIOR



SECRETARY OF AGRICULTURE



SECRETARY OF COMMERCE



SECRETARY OF LABOR



NAVY COMMISSION PENNANT



IMMIGRATION SERVICE



COAST GUARD



UNITED STATES ACK



COAST AND GEODETIC SURVEY



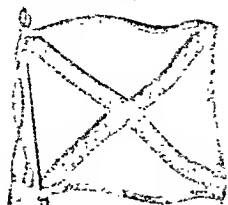
PUBLIC HEALTH SERVICE



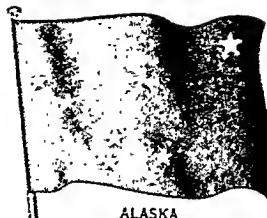
FISH AND WILDLIFE SERVICE

FLAGS of the STATES

STATES AND
INCORPORATED
TERRITORIES



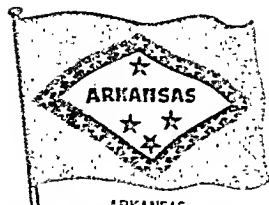
ALABAMA



ALASKA



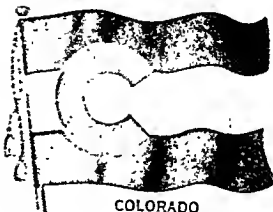
ARIZONA



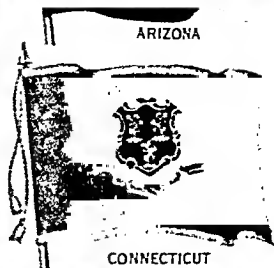
ARKANSAS



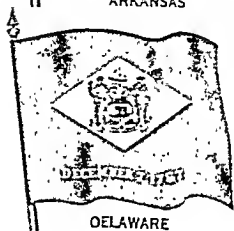
CALIFORNIA



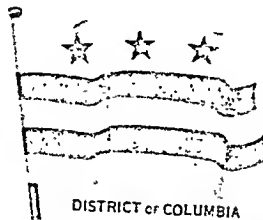
COLORADO



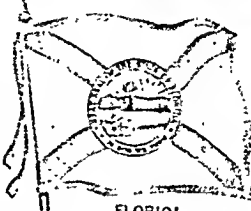
CONNECTICUT



DELAWARE



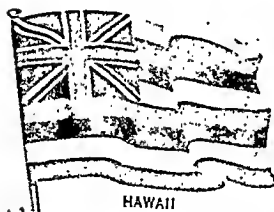
DISTRICT of COLUMBIA



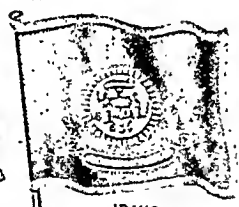
FLORIDA



GEORGIA



HAWAII



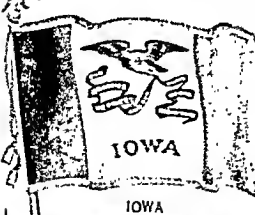
IDAHO



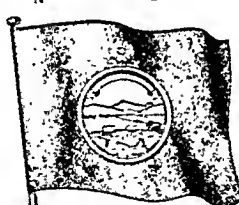
ILLINOIS



INDIANA



IOWA



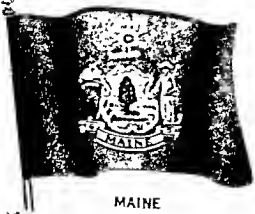
KANSAS



KENTUCKY



LOUISIANA



MAINE



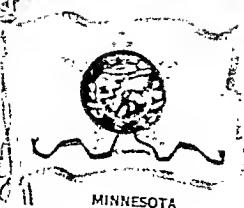
MARYLAND



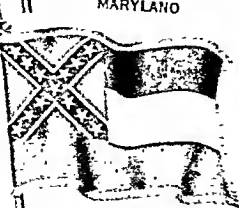
MASSACHUSETTS



MICHIGAN



MINNESOTA



MISSISSIPPI



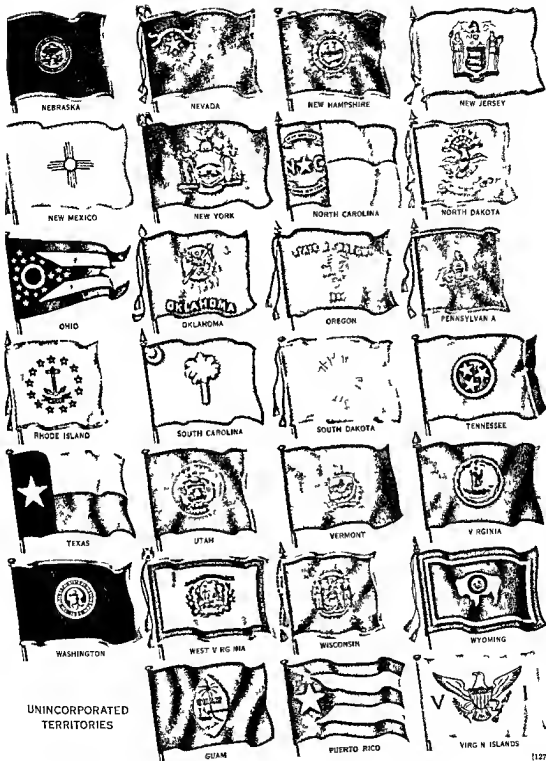
MISSOURI



MONTANA

FLAGS of the STATES

CONT. NEXT

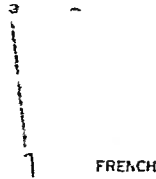


FAMOUS FLAGS *in* AMERICAN HISTORY

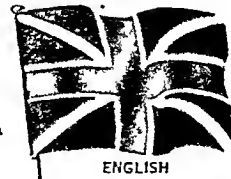
FLAGS OF DISCOVERY AND SETTLEMENT



COLUMBUS



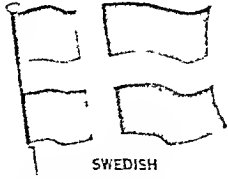
FRENCH



ENGLISH



DUTCH



SWEDISH

COLONIAL AND REVOLUTIONARY FLAGS



ANONOS



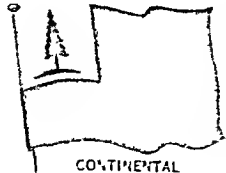
TAUNTON



NEW ENGLAND



BEDFORD



CONTINENTAL



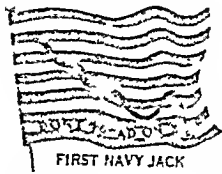
BUNKER HILL



CULPER



WASHINGTON



FIRST NAVY JACK



DONT TREAD ON ME
GADSDEN



AN APPEAL TO GOD
DONT TREAD ON ME
MASSACHUSETTS NAVY



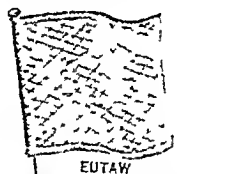
LIBERTY TREE



LIBERTY
FORT MOULTRIE



RHODE ISLAND



EUTAW

EVOLUTION OF THE STARS AND STRIPES



CAMBRIDGE



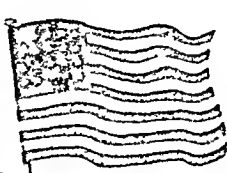
BENNING



JUNE 14 1777



3d MARYLAND REGIMENT

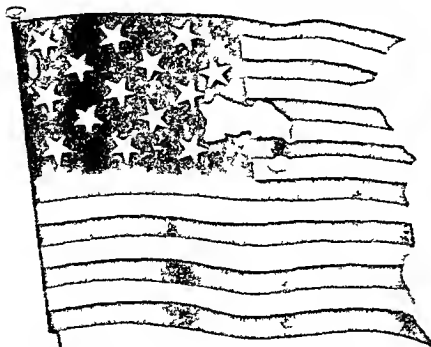


JULY 4 1818

FLAGS OF THE 1800'S



RUSSIAN-AMERICAN



THE STAR SPANGLED BANNER
FORT M' HENRY



OLIVER PERRY



1824
ALAMO



TEXAS NAVY



CALIFORNIA REPUBLIC
CALIFORNIA REPUBLIC



BONNIE BLUE



CONFEDERATE
BATTLE FLAG

American Flags and Their Romantic Stories

Emblems of the United States

(These emblems appear on page 125)

The Stars and Stripes— Old Glory How did the design of the American flag originate? Strange as it may seem, no one really knows. Tradition credits Betsy Ross with making the first flag in her Philadelphia shop in 1776. Historians however have doubted the accuracy of this story (see Ross). It is known that on June 14, 1777, Congress authorized the stars and stripes design (see page 128). Whether Betsy Ross suggested the design approved by Congress is not known. Thirteen stripes appeared in several Revolutionary War flags made before the flag committee of 1777 began its work. No one knows who suggested these stripes in the earlier flags. One theory is that both the stripes and stars were taken from the coat of arms of the Washington family. This shield had three five-pointed stars with two red stripes below and its crest contained a raven with wings outspread like the spread eagle of the United States Great Seal (see below).

The American flag as accepted in 1777 had 13 stripes and 13 stars but in 1795 it was given 15 stripes and 15 stars to honor the admission of Vermont and Kentucky to the Union. By 1812 it needed three more stripes and stars. But no change was made until July 4, 1818, when Congress restored the 13 stripes authorized 20 stars and ordered one star added to the flag for every new state admitted to the Union. The name *Old Glory* is believed to have been given the flag by Capt. William Driver commanding the brig *Charles Duggett* in 1824.

The proper legal dimensions of the United States flag were prescribed by executive order of President Taft Oct. 29, 1912, as follows: Hoist (height) of flag 1 (unit). Fly (length) of flag 1 9. Hoist of canton or union (blue field) 7/13. Fly of canton 0 76. Width of each stripe 1/13. Diameter of each star 0 0616.

Great Seal of the United States On June 20, 1782, the Continental Congress adopted its seal from several designs combined into one by Charles Thomson, secretary of Congress and William Barton, an adviser. In 1789 Congress authorized it as the seal of the United States. It is used on proclamations, treaties and commissions of officials. Both sides of seal appear on one dollar bills. The eagle bears a shield without support signifying that the United States should rely on its own virtues. Olive branch and arrows in talons refer to power of peace and war held by Congress. The scroll *E Pluribus Unum* (One Out of Many) the 6 red and 7 white stripes (joined by a blue chief on the shield) and the constellation of 13 stars all represent a new nation of 13 states. The original description of the Great Seal suggested the following color symbolism: white—purity and innocence; red—hardness and valor and blue—vigilance, perseverance and justice.

On reverse side a pyramid denotes strength. The motto *Novus Ordo Seclorum* (A new order of ages) and *MDCCLXXVI* (1776) are for Declaration of Independence. An eye and words *Anno Coepit* (He has favored our undertakings) refer to favor of Providence.

President Adopted Oct. 25, 1945. The president's personal seal appears on a blue field surrounded by a circle of 48 stars. Within the circle an American eagle turns its head toward the right (dexter) talon hold-

ing the olive branch of peace. The left (sinister) talon holds the 13 arrows of war. In the eagle's beak is a white scroll inscribed *E Pluribus Unum*. The seal adopted Oct. 25, 1945 and flag were both redesigned upon the order of President Truman. Formerly the eagle in both the seal and the flag faced left.

When the president visits a United States warship his flag is displayed upon the mainmast during his stay. When a vessel carrying the president flies his flag, passing naval vessels parade the full guard, four ruffles are given on a drum, four flourishes are sounded on a bugle.

The Star Spangled Banner is played by the band and officers and men salute. All saluting ships on meeting a vessel flying the president's flag fire a national salute on passing; all naval batteries salute him in the same way. At a military post the president is received with regimental colors or standards, officers and troops salute, drums give four ruffles, bugles sound four flourishes, the national anthem is played (or bugles sound *To the Colors*) and a salute of 21 guns is fired. Upon his departure another 21 guns are fired.

Vice President Adopted 1915. It replaced the first vice-president's flag designed in 1936. The earlier flag was simply the president's flag with colors reversed.

Secretary of State Adopted 1933. In this flag the coat of arms of the United States has a white rather than the usual buff background.

Secretary of Treasury This flag was used as early as 1914. The records of its adoption were destroyed by fire. Thirteen stars also appear on the department seal.

Secretary of Defense Adopted 1947 when cabinet post was created. Three arrows represent component parts of the department—Army, Navy and Air Force. Four stars represent civilian rank as head of department and take precedence over five-star military rank.

Secretary of the Army Adopted 1897. This flag was designed for the secretary of war. In 1947 it was taken over by the secretary of the army.

Secretary of the Navy Adopted 1866. Flag was abolished in 1870 but restored in 1876. In the interim the United States Jack was the flag of the secretary of the navy.

Secretary of the Air Force Adopted 1947. Blue and orange colors and the center device symbolize Air Force when it was part of the Army prior to 1947.

Marine Corps Standard adopted as the regimental flag 1933. Flag redesignated as the corps standard 1940. Major Marine Corps units have their own standard and with their unit name on scroll.

Attorney General Adopted 1932. Motto may be translated as *He who seeks justice for the people* or *Who prosecutes in behalf of our Lady Justice*.

Postmaster General Adopted 1921. The galloping horse commemorates the Pony Express.

Secretary of Interior Adopted 1934. Seven stars represent seven chief activities of department when flag was designed.

Secretary of Agriculture Adopted 1941. Center device is department seal. It has 41 stars representing the number of states in the Union when seal was adopted 1891.

Secretary of Commerce Adopted 1910 for secretary of commerce and labor department. New center device

(department seal) was adopted 1913 when commerce became an independent department.

Secretary of Labor. Adopted 1913. Center device is department seal showing symbols of labor: anvil, pulley and lever, inclined plane, and plow.

Navy Commission Pennant. Flown by all ships of the United States Navy in commission unless replaced by flag, or pennant, of command (an officer above rank of captain).

Immigration and Naturalization Service. Present form adopted 1903 except seal of department of justice added in 1940. The swallow-tailed, triangular shape is called a *burgee*.

Coast Guard. Ensign adopted 1799. This is the oldest unchanged flag in the United States. Sixteen stripes represent the 16 states of 1799. Without the hodge on the seventh red stripe, this flag represents the United States Customs Service.

United States Jack. Adopted 1777 with 13 white stars on a blue field. The number of stars increased as new stars were added to canton of United States flag. This small flag is most commonly flown by government vessels when moored or anchored. It is hoisted from the jack staff (at the bow) from morning to evening colors.

Coast and Geodetic Survey. Adopted 1899. Triangle symbolizes basic surveys conducted by the bureau.

Public Health Service. Quarantine flag adopted 1894. Fouled anchor and caduceus (Mercury's staff) device represents original function of providing medical care for merchant seamen. The same hodge in white on a blue field represents the surgeon general of the Public Health Service.

Fish and Wildlife Service. Masthead flag adopted 1940. Canadian blue goose and Pacific salmon symbolize conservation of the nation's natural resources.

Flags of the States and Territories

(These flags appear on pages 126 and 127)

States and Incorporated Territories

Alabama. Adopted Feb. 16, 1895. The cross of St. Andrew was adopted from the Confederate battle flag used during the Civil War.

Alaska. Adopted May 2, 1927. Selected from 142 designs made by school children of territory in contest conducted by American Legion. Designer was Bennie Benson, 13-year-old pupil in seventh grade of Mission Territorial School near Seward. The blue typifies the evening sky, the sea, the mountain lakes, and the wild flowers. The eight gold stars represent wealth hidden in Alaska gold mines. Seven stars form the "Big Dipper"; the eighth is Polaris, the North Star.

Arizona. Flag of battleship *Arizona*, adopted as state flag Feb. 27, 1917. The copper-colored star of Arizona rises from a blue field in face of setting sun. State's colors, blue and gold, are joined with old Spanish colors, red and yellow.

Arkansas. Adopted Feb. 26, 1913 (modified April 4, 1924). The 25 white stars show Arkansas was 25th state in Union. Three blue stars below "Arkansas" signify the three nations, Spain, France, and United States, to which the state successively belonged. They also indicate that Arkansas was the third state carved out of the Louisiana Purchase. Star above "Arkansas" commemorates Confederacy. Diamond pattern signifies that Arkansas is Union's only diamond-producing state. Flag was designed by Miss Willie Hocker of Pine Bluff, Ark.

California. Adopted Feb. 3, 1911. Flag was designed by William Todd for short-lived "Bear Flag Republic" (June 14-July 10, 1846). First raised at Sonoma, Calif., June 14, 1846, it shows the largest of bears, the extinct California grizzly.

Colorado. Adopted June 5, 1911; new description authorized Feb. 28, 1929. The golden disk filling center of "C" should be one-sixth width of flag, but larger "C" is usually used. The blue represents the skies; the gold, sunshine; the white, snow-capped mountains; and the red, the Spanish interpretation of Colorado. The gold and silver cord and tassels signify two of the state's principal metals.

Connecticut. Adopted June 9, 1897. State seal, adopted 1931, shows three grapevines to represent three original colonies of Connecticut—Hartford, Windsor, and Weth-

ersfield. Below is state motto "Qui Transtulit Sustinet" (He who brought us over sustains us)—an inscription from state's colonial banner.

Delaware. Design selected July 24, 1913, by committee appointed by state House of Representatives; not adopted by Assembly but accepted as official. Buff diamond contains state coat of arms, adopted 1847. Below is inscription "December 7, 1787," date Delaware ratified Federal Constitution. Delaware was first state to do so.

District of Columbia. Adopted Oct. 15, 1938. The design is taken from the shield of the Washington family coat of arms. Design is credited to A. E. DuBois, then head of Heraldic Section of War Department.

Florida. Design established by state constitution of 1868; diagonal red bars added 1900. State seal, adopted Aug. 6, 1868, shows sun's rays over highland in distance, a coconut tree, steamboat on water, and Indian woman scattering flowers; seal encircled by words "Great Seal of the State of Florida" and "In God We Trust."

Georgia. Adopted Oct. 17, 1879; reaffirmed May 21, 1916. State seal, redesigned 1914, shows three pillars with "Wisdom, Justice, Moderation," for the legislative, judicial and executive, branches of government. Arch above pillars is inscribed "Constitution." The whole is encircled by "State of Georgia, 1776."

Hawaii. Established 1845; adopted 1903. Crosses of St. Andrew, St. George, and St. Patrick in canton taken from United Kingdom flag (see page 133). Eight stripes represent eight main islands of Hawaiian group.

Idaho. Authorized March 12, 1907. Center coat of arms, adopted 1891, is moose-crested escutcheon with a blazing sun rising above three mountain peaks and a river in foreground. On one side is miner with pick and shovel, on other, woman hearing scales and spear with cap of liberty. Above crest is legend "Esto Perpetua" (May she endure forever).

Illinois. Authorized July 6, 1915. Design from state seal, adopted 1867, shows eagle perched on rock along-side American shield. Scroll in its beak contains motto "State Sovereignty—National Union." Design submitted by Rockford Chapter of the Daughters of the American Revolution.

Indiana Adopted May 31 1917 Designed by Paul Hadley of Mooreville Ind. It was selected from 200 competitive designs by Daughters of the American Revolution. The 13 stars around torch represent 13 original states. Inner half circle of five stars represents five other states admitted to Union before Indiana. and large star above torch represents Indiana. Torch signifies liberty and enlightenment.

Iowa Adopted March 29 1921. Pennant in eagle's beak reads: Our Liberties We Prize and Our Rights We Will Maintain. Red white and blue stripes refer to time when Iowa was under French Louisiana flag.

Kansas Adopted March 23 1927. In state seal adopted 1861 agriculture is represented by plowman; commerce by river and steamboat; early history by herd of buffalo fleeing from two Indians on horseback; and by westbound prairie schooners. Motto reads: *Ad Astra per Aspera* (To the stars through difficulties). Above seal is state military crest: sunflower on bar of gold and blue. Kansas was 34th state to enter Union indicated by 34 stars in seal.

Kentucky Approved March 26 1918. State seal encircled by wreath and words: Commonwealth of Kentucky. Center of seal shows two men shaking hands and the legend: United We Stand Divided We Fall. Basic design of seal used since 1792.

Louisiana Adopted July 1 1912 but first flown about time of War of 1812. State seal in center shows white pelican feeding young symbolizing devotion. On white ribbon below is state motto: Union Justice and Confidence. Seal first authorized by law in 1902.

Maine Adopted Feb. 24 1909. In center is state coat of arms adopted 1820 showing pine tree, moose lying at foot of it, farmer resting on scythe and a sailor resting on anchor. In crest is North Star over shield is *Dingo* (I defend).

Maryland Adopted March 9 1904 but used since the founding of the colony. First and fourth quarters of flag represent Lord Baltimore's paternal coat of arms (Calvert); second and third quarters represent his maternal coat of arms (Crossland).

Massachusetts Adopted March 18 1908 revised March 6 1915. State seal in center shows blue shield with Indian holding bow in right hand and arrow in left hand and a five-pointed silver star above his right arm. Above shield is an arm bent at elbow the hand grasping a broadsword and on scroll the motto: *Ense Petit Placidam sub Libertate Quietem*. The motto adopted in 1775 means: By the sword this hand seeks peace but peace only under liberty. Seal has been in use since 1780. Reverse of flag shows blue shield bearing a green pine tree on field of white.

Michigan Adopted Aug. 1 1911. In center is state coat of arms with word: *Tuebor* (I will defend) referring to state's early frontier position. On lower part of shield is a rising sun and man standing on peninsula. his right arm raised and left arm resting on a gun stock. Scroll below shield reads: *Si Quæris Peninsulam Amœnam Circumspice* (If you seek a beautiful peninsula look about you). Shield is supported by an elk and a moose and surmounted by an American eagle and motto: *E Pluribus Unum*. Seal similar to that of Hudson's Bay Company has been in use since 1835.

Minnesota Adopted Feb. 28 1893. State seal adopted 1858. In center has wreath of white mosses and flowers. Red ribbon bears motto: *L'Étoile du Nord* (Star of the North). Seal bears dates 1819 date of settlement 1858 date of admission to Union and 1893

date of adoption of flag. The 19 stars surrounding seal indicate Minnesota was 19th state admitted to Union after the original 13. Large star at top typifies Minnesota as North Star state. Seal represents pushing out of civilization against the Indians. A white man, his gun resting on a stump is plowing while an Indian moves toward the setting sun. Flag standard is surmounted by a golden gopher. Designer was Mrs. Edward H. Center of Minneapolis.

Mississippi Adopted Feb. 7 1894. Square canton at upper left represents old Confederate battle flag (see page 128). Staff is surmounted with battle-axe.

Missouri Adopted March 22 1913. State coat of arms in center adopted Jan. 11 1822 is surrounded by circle of 24 stars representing Missouri as 24th state of Union. Roman numerals MDCCCXX indicate 1820 the year Missouri was admitted to the Union. Motto is: *Salus Populi Suprema Lex Esto* (The welfare of the people is the supreme law).

Montana Adopted Feb. 27 1905. State seal in center approved March 2 1893 shows brilliant sun setting behind mountains. In foreground are a plow a miner's pick and shovel and the Great Falls of the Missouri. Scroll below reads: *Oro y Plata* (Gold and silver). Flag is copy of emblem carried by First Montana Infantry in Spanish American War.

Nebraska Adopted March 28 1925. Center is state seal adopted June 15 1867 with steamboat ascending Missouri River, blacksmith with hammer and anvil representing mechanical arts, settler's cabin and sheaves of wheat for agriculture and train of cars heading toward Rocky Mountains. Motto at top reads: *Equality before the law*. Design suggested by Mrs. B. G. Miller of Crete, Neb.

Nevada Adopted March 26 1929. Two sprays at upper left are sagebrush. Yellow scroll reads: *Battle Born* referring to state's admission to Union during Civil War.

New Hampshire Adopted Feb. 24 1909. In use since 1784. State seal shows the frigate *Raleigh* one of the first ships ordered for the American Navy. Surrounding the vessel is a wreath and the words: *Seal of the State of New Hampshire 1776*. Seal was adopted April 29 1931.

New Jersey Adopted March 26 1896. Flag buff because in 1779 by authorization of Congress Washington selected blue and buff uniforms for regiments of New Jersey Continental Line. Washington is said to have chosen buff facings for troops of both New York and New Jersey. These colors were originally settled by Dutch and Jersey blue and buff were part of Netherlands insignia. Legend below coat of arms reads: *Liberty and Prosperity*. Seal officially adopted 1928.

New Mexico Adopted March 19 1925. In center is symbol for the sun used by Zia Indian Pueblo to represent New Mexico's sunshine and to acknowledge the aid Indians gave the settlers by their knowledge of irrigation. The red and yellow are colors of old Spain which once ruled New Mexico. Flag was designed by Dr. Harry Mera of Santa Fe.

New York Adopted April 8 1896. Color of field changed from buff to blue in 1901. State coat of arms in center which dates from March 16 1778 has sun rising behind range of mountains. In foreground are ship and sloop on Hudson River above American eagle and globe. At left of shield is blue-robed figure of Liberty with coronet of pearls; her right hand holds staff crowned with liberty cap of gold; her left foot rests on royal crown symbol of emancipation from

monarchy. To right of shield is golden-robed Justice, eyes bound, scales in left hand.

North Carolina. Adopted March 9, 1835. Top date, May 20, 1775, is that of Mecklenburg Declaration—a series of resolutions that may have been the earliest assertion of independence from Great Britain made in the colonies. Other date, April 12, 1776, indicates Halifax Convention in which North Carolina became first of all the colonies to direct its delegates in Continental Congress at Philadelphia to vote for independence.

North Dakota. Adopted March 3, 1911. Design based on regimental colors of First North Dakota Infantry in Spanish-American War and Philippine Insurrection. Words "North Dakota" on scroll were added by state legislature.

Ohio. Adopted May 9, 1902—only state flag in hurgee shape. The triangles formed by main lines of flag represent hills and valleys, the stripes, roads and waterways. The 13 stars grouped about circle represent 13 original states. Circle represents the Northwest Territory, and additional four stars indicate Ohio was 17th state in Union. White circle represents initial letter of Ohio and red circle suggests name "Buckeye State." Flag was designed by John Eisenmann.

Oklahoma. Adopted April 2, 1925. Rawhide shield of Osage Indian in center has fringe of eagle feathers and is crossed by olive branch and calumet, or peace pipe. Design signifies love of peace by a united people and defensive warfare when justifiable.

Oregon. Adopted Feb. 26, 1925. Shield, from seal, in center, shows wagon, Pacific Ocean, British man-of-war departing, and American steamer arriving. Below words "The Union" are a sheaf, a plow, and a pickax. Date "1859" indicates Oregon's admission to Union; 33 stars refer to number of states at that time. Reverse of flag is blue, with golden beaver in center. Seal adopted 1903.

Pennsylvania. Adopted June 13, 1907. State coat of arms in center shows ship sailing ocean, plow, sheaves of wheat; supported by harnessed horses. Below eagle is motto "Virtue, Liberty and Independence." Seal adopted 1893.

Rhode Island. Adopted May 19, 1897. The 13 gold stars represent original states; the anchor and word "Hope" marked Rhode Island's distinctive colonial flag (see page 123).

South Carolina. Adopted Jan. 28, 1861, when South Carolina declared itself independent. When state later entered the Confederacy, the blue flag of the white palmetto and crescent became the state flag; and it has since so remained. Colonel William Moultrie first designed flag in 1775. Palmetto tree added in 1777.

South Dakota. Adopted March 8, 1909. Golden sun in center is surrounded by words "South Dakota the Sunshine State." Reverse of flag has state seal, adopted 1889, showing river with steamboat, farmer with plow, herd of cattle, field of corn, smelting furnace, hills, and motto "Under God the people rule." (Seal on reverse is contrary to usual flag practice.)

Tennessee. Adopted April 17, 1905. The three stars in blue disk indicate the state's three natural divisions—east, middle, and west—bound into one by circular blue field. Three stars also indicate Tennessee was the third state to enter the Union after the original 13. Flag was designed by Capt. Leroy Reeves of the third Regiment of Tennessee Infantry.

Texas. Adopted Jan. 25, 1839. This flag, dating from the days of the "Lone Star Republic," is the only state

emblem that was originally the flag of a recognized independent country. It replaced the first Texas national flag, which was blue with a central gold star.

Utah. Adopted March 9, 1911, central design revised March 11, 1913. On shield below eagle is beehive in clump of sego lilies, above which is word "Industry." Date "1847" is that of founding of state by Mormons, who formed an independent government and called it "State of Deseret" (Deseret means "the land of the honeybee"). Below draped flags is date "1896," the year of admission to Union. Seal adopted 1896.

Vermont. Adopted March 26, 1923. In center is state coat of arms: pine tree, three sheaves of wheat, and a red cow from state seal, against a mountain background. Seal designed 1778; adopted 1937.

Virginia. Adopted April 30, 1861; reaffirmed March 24, 1930. In center is state seal, adopted July 5, 1776, showing Virtus, genius of the Commonwealth, dressed like Amazon, spear in one hand and sword in other. She is tramping on prostrate Tyranny, whose crown has fallen off and who holds a broken chain in one hand and scourge in other. Below Virtus appear words "E: Semper Tyrannis" (Thus ever to tyrants).

Washington. Adopted Jan. 2, 1923. In center is state seal in gold. Seal displays portrait of George Washington. Date "1889" at base of portrait is that of admission to Union. Seal adopted 1889.

West Virginia. Adopted March 7, 1929. In center is state coat of arms, adopted Sept. 26, 1863, showing rock covered with ivy, inscribed "June 20, 1863," date of admission to Union. Farmer in hunting clothes supports woodman's ax with left hand and rests his right on plow handle, indicating that state was partly cultivated and partly being cleared of original forests. Other figure is a miner with pickax on shoulder and lumps of mineral at his feet. At his left are anvil and sledge hammer, typical of mechanical arts. Two crossed rifles and liberty cap in foreground indicate freedom was won and will be defended by arms. Motto is "Montani Semper Liberi" (Mountaineers always free). Reverse shows sprig of rhododendron, the state flower.

Wisconsin. Adopted April 26, 1913. State coat of arms in center shows plow, crossed shovel and pick, arm and hammer, and anchor. Shield is supported by sailor holding coil of rope and laborer holding pick. Above is badger and motto "Forward." Seal designed 1851; redesigned 1881.

Wyoming. Adopted by state legislature Jan. 31, 1917. Flag designed by Vera Keays of Buffalo, Wyo. Red border represents Indians and blood shed by pioneers; white, purity and uprightness; blue, fidelity, justice, and virility. Buffalo was chosen as representative native animal. On buffalo's ribs appears great seal of state, adopted 1893, amended 1921.

Unincorporated Territories

Guam. Adopted by Guam congress 1948. It was formerly the flag of the governor of that territory. In the center device, an ancient flying proa (canoe) approaches the shore where a lone palm tree grows.

Puerto Rico. Adopted July 25, 1952, when island became a "commonwealth." Colors are those of the American flag; design that of Cuban flag. Governor's flag is the great seal of Puerto Rico on a white field.

Virgin Islands. Adopted May 17, 1921. The American eagle grasps three blue arrows in one talon and a sprig of green laurel in the other. On its breast is the shield of the United States. Flag was authorized by Sumner Kittelle, then governor of the Virgin Islands.

Famous Flags in American History

(These flags appear on page 128)

Flags of Discovery and Settlement

Columbus When Christopher Columbus discovered America in 1492 he was carrying the quartered flag of Castle and Leon. This banner represented Ferdinand and Isabella of Spain. Other explorers who carried the Spanish flag to America included Ponce de Leon, Hernando de Soto and Coronado. After 185 the historic red and orange striped flag of royal Spain flew briefly over Florida and the Louisiana Territory.

French *Fleurs-de-lis* on a white field was one of the three flags carried to America by early French explorers and settlers. Other flags were a plain white banner and a blue flag decorated by three *fleurs-de-lis* (see page 131). A fourth French emblem, the tri-color (see page 132) was flying over the Mississippi Valley at the time of the Louisiana Purchase in 1803.

English This British Union flag (1606-1801) was carried by the Jamestown settlers (1607) and the Pilgrims of the *Mayflower* (1620). Many of the early English explorers and settlers also carried the red cross of St. George on a white field (see page 131). This old British Union flag, the forerunner of present British Union, was flown in the American Colonies until the Revolution.

Dutch When Henry Hudson sailed the *Half Moon* into New York harbor in 1609 he flew the orange, white and blue flag of the Netherlands. The letters A O C were the initials of *Algemene Oost-Indische Compagnie*—a Dutch East India Company. In 1621 the letters were changed to G W C, the initials of *Geenootschaap West-Indische Compagnie*—a Dutch West India Company. About 1650 red replaced orange as the color of the top stripe. In 1664 the flag disappeared from the New World when the Dutch lost their New Netherlands settlement to the English.

Swedish The Swedish colonists who settled along the Delaware River in 1638 carried this flag, a yellow cross on a blue field. In 1655 the flag was lowered when the Dutch took over the Swedish settlement.

Colonial and Revolutionary Flags

Andros In use 1686 Edmund Andros became governor of all New England in 1686. His flag was the red cross of St. George with a gold crown and the letters J R (for the Latin *Jacobus Rex*) the monogram of King James. Andros was deposed in 1699.

Taunton First raised 1774 at Taunton, Mass. Flag was the British red ensign of that time with the addition of the American watchwords: Liberty and Union.

New England In use 1775. It carried the red cross of St. George in the canton with the New England pine tree in the upper left corner of the cross.

Bedford In use 1775. Minutemen from Bedford, Mass. carried this 2½-foot square flag at the battle of Lexington and Concord April 19, 1775. An arm and sword thrust out from a cloud. Three round gray spots are cannon balls and the scroll reads: *Vince aut Monere* (Conquer or die).

Contestable In use 1775. This flag and the Bunker Hill flag (see Bunker Hill flag) are both believed to have been carried at battle of Bunker Hill June 17, 1775. John Trumbull's painting of the battle shows this flag probably evolved from the New England ensign. Other paintings show the Bunker Hill flag.

Bunker Hill In use 1775. American colonists probably carried this flag as well as the Continental flag at the battle of Bunker Hill (see Continental flag). An earlier flag (in use 1737) had a globe instead of a pine tree in the upper left-hand corner. Both of these flags were modelled on old English blue ensign.

Culpeper In use 1775. Culpeper County, Va. was a Revolutionary War center and its minutemen flew this banner. The rattlesnake device occurs on several Revolutionary War flags. The rattlesnake's eye, brighter than any other creature's and with no eyelids, is the emblem of vigilance. The snake never begins an attack but once aroused it never surrenders. Probably the deadly bite of the rattler was also considered. Snake often portrayed with 13 rattles, symbolic of the 13 colonies.

Washington's Cruisers In use 1775. The six cruisers of General Washington's Revolutionary War Navy flew this flag before the Cambridge flag was adopted as the Navy ensign. This flag was flying on the *Lee* when it captured the English brig *Nancy* with its precious cargo of ammunition Nov. 29, 1775. The *Lady Washington* surrendered the pine-tree emblem when it was captured by *H. M. S. Foucy* on Dec. 7, 1775.

First Navy Jack Hoisted 1775 at Philadelphia on the jackstaff of the *Alfred*, the flagship of the Navy's first commander—Commodore Esek Hopkins. At the same time the Cambridge flag became the Navy ensign (see Gadsden flag below and Cambridge flag).

Gadsden Hoisted 1775 on the mainmast of the *Alfred*. This flag was presented by Col. Christopher Gadsden to Commodore Esek Hopkins for use as his personal emblem. Hoisted at the same time were the Navy Jack and the Cambridge flag. Similar flags made with white background are often confused with Gadsden flag.

Massachusetts Navy Adopted April 29, 1776. This ensign of the Massachusetts Navy was based on the flag of Washington's cruisers. The rattlesnake and motto "Don't tread on me" were added.

Liberty Tree In use 1776. Massachusetts council adopted this flag in April 1776. Liberty Tree is found on several Revolutionary War flags. Boston had a Liberty Tree, a fine old elm in Hanover Square under which the Sons of Liberty met just before the Boston Tea Party. For that reason General Gage ordered it cut down. Another famous tree was a spreading live oak in Charleston near home of Christopher Gadsden. Under this oak Revolutionary War leaders met to talk and there the Declaration of Independence was first read to people of Charleston. Flag is sometimes shown without the top and bottom blue stripes.

Fort Moultrie In use 1776. This flag flew above Fort Moultrie (then Fort Sullivan) in Charleston Harbor during famous battle of June 28, 1776. Early in the attack flag fell outside the parapet. Sergeant William Jasper leaped after it under a rain of bullets crying: "Don't let us fight without a flag. He replaced it amid cheers. After a ten-hour attack the British forces withdrew. Name of fort was changed to honor defender.

Colonel Moultrie First Moultrie flag (designed 1775) contained only the crescent on a blue field. In 1777 palmetto tree replaced the word Liberty and flag became emblem of South Carolina.

Rhode Island. In use 1776. Colonists carried this flag at battles of Trenton, Brandywine, and Yorktown. It is now preserved in State House at Providence. Thirteen stars are arranged to form crosses of St. George and St. Andrew.

Eutaw. In use 1781. This crimson square flew both at Cowpens and at final battle of Revolution at Eutaw Springs in 1781. It was battle flag of the cavalry of Col. William Washington, a distant cousin of George Washington. It was presented to him by his fiancée, Miss Jane Elhot of South Carolina, who cut the emblem from the back of a drawing-room chair.

Evolution of Stars and Stripes

Cambridge, or Grand Union. In use 1775. On July 4, 1776, it became the first national flag of the United States. John Paul Jones is believed to have hoisted this flag in 1775, as the Navy ensign when Commodore Esek Hopkins assumed command of the new Navy (see First Navy Jack and Gadsden flag). An English spy reported that Hopkins' flagship (the *Alfred*) was flying "English colours, but more striped." This flag was also hoisted on Prospect Hill near Cambridge, Mass. (General Washington's headquarters), on Jan. 1, 1776, as the flag of the Continental Army. The basis of the design is uncertain. Never officially adopted, the flag was replaced by the emblem described in the Continental Congress resolution of June 14, 1777.

Bennington. In use 1776. This flag was flown at the battle of Bennington, Aug. 16, 1777, when 2,000 Green Mountain boys under Gen. John Stark wiped out forces of General Baum, contributing to the later defeat of General Burgoyne at Saratoga, N. Y.

Flag of June 14, 1777—the first official Stars and Stripes. Although the design of the Stars and Stripes may have been used before its adoption by Congress on June 14, 1777, there is no official record to indicate its earlier use as shown in some paintings. Many of these paintings were produced long after the events represented, and the artists may have shown the Stars and Stripes as in use before the design existed. For example, Emanuel Leutze painted 'Washington Crossing the Delaware' in 1851, 75 years after the event. Congress did not direct a specific arrangement of the 13 stars. (In the Navy it became customary to place the stars as in the banner of Rhode Island above.) The sponsor of this first national flag law is unknown, although the resolution is believed to have originated in the Marine Committee. The flag served until May 1, 1795 (see Fort McHenry flag).

Third Maryland Regiment. In use 1781. At the battle of Cowpens, S. C., Jan. 17, 1781, the Third Maryland Regiment carried this flag. It had the 13 stars and stripes as prescribed by Congress in 1777. But the Marylanders chose to arrange the stars in a circle of 12 with one in the center. This is believed to be the only use of the Stars and Stripes by ground troops until the Mexican War.

July 4, 1818. With adoption of this flag on July 4, 1818 (by a law passed on March 4, 1818), the Stars and Stripes began to assume its present appearance. Some favored adding a stripe for each new state, but Congress restored the 13 stripes and ordered the addition of one star for each new state, such addition to take effect the 4th day of July succeeding each admission.

Flags of the 1800's

Russian-American Company, Alaska. The reign of traders' lawlessness in Alaska was checked in 1799 by formation of the Russian-American Company. The

flag flew from ships and trading posts until 1867, when Alaska was purchased by the United States.

Fort McHenry. The flag that floated over Fort McHenry in 1814 inspired Francis Scott Key to write 'The Star Spangled Banner.' Authorized by Congress in 1795, it was still in use despite the fact that there were then 18 states in the Union. It remained unchanged until 1818 (see flag of July 4, 1818). Except in bad weather, the American flag flies during the day over the grave of Francis Scott Key in Mount Olivet Cemetery, Frederick, Md.

Oliver Perry. At battle of Lake Erie, Sept. 10, 1813, Oliver Hazard Perry, in command of a new fleet, unfurled this flag. It bore the stirring words "Don't give up the ship," spoken by Capt. James Lawrence when he was mortally wounded in the battle between the *Chesapeake* and the *Shannon*, June 1, 1813.

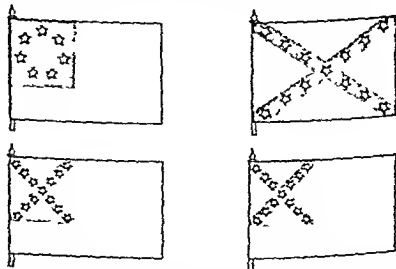
Alamo. When Texas was fighting for independence from Mexico, this flag floated over the historic mission fortress, the Alamo, at San Antonio. On March 6, 1836, the Mexicans captured the fortress. "Remember the Alamo" became the Texans' rallying cry. Date on flag refers to constitution of 1824.

Texas Navy. President Burnet of Texas adopted this naval flag April 9, 1836. It was approved Dec. 10, 1836, at first session of the Texas congress. This was the first "lone-star" flag bearing governmental sanction, though similar flags had been in use earlier. On Dec. 10, 1836, the Texas congress also adopted a national flag for the republic which bore a gold star centered in a blue field. On Jan. 25, 1839, both flags were replaced by a new emblem which later became the state flag (see Texas, page 127).

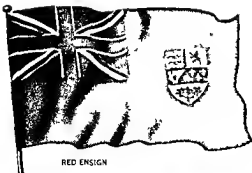
California Republic. When American settlers in California organized the California Republic June 14, 1846, they adopted this flag. The flag was replaced by the Stars and Stripes July 10, 1846. It is now the California state flag.

Bonnie Blue. In 1861 Harry McCarthy, an Irish comedian, sang his song 'Bonnie Blue Flag' in New Orleans. His sister carried a blue flag with a white star to honor the Texans present. So enthusiastically was the song received, it became popular in the South. The flag was used until the Confederacy adopted its own flag.

Confederate Battle Flag. During the battle of Bull Run (Manassas), July 21, 1861, soldiers had difficulty distinguishing between Confederate and Union flags. As a result, Southern soldiers began carrying this battle flag. Although it was never officially adopted, many Confederate soldiers never saw any other flag. It was sometimes made with a white border on all four sides. The four official flags are shown below.



The Stars and Bars (top left), adopted March 4, 1861, was red and white with a blue canton. The naval jack (top right) was used after May 1, 1863. The third flag (bottom left) was adopted May 1, 1863. A red bar was added March 4, 1865 (bottom right).



RED ENSIGN

FLAGS *and* SHIELDS of CANADA



ARMORIAL
BEARINGS

SHIELDS OF THE PROVINCES



ALBERTA



BRITISH COLUMBIA



MANITOBA



NEW BRUNSW CK



NEWFOUNDLAND



NOVA SCOT A



ONTARIO



PRINCE EDWARD
ISLAND

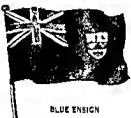


QUEBEC



SASKATCHEWAN

CANADIAN FLAGS OF TODAY



BLUE ENSIGN



GOVERNOR GENERAL



NOVA SCOTIA



QUEBEC

HISTORIC FLAGS OF CANADA



VIKINGS



ST GEORGE'S CROSS



FRANCE (1500-1580)



FRANCE (1580-1793)



ST ANDREW'S CROSS



BRITISH UNION (c. 15-18)

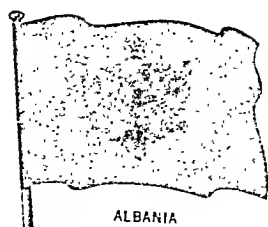


BRITISH RED ENSIGN (1793-1907)

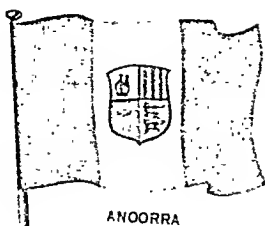


BRITISH UNION (1907)

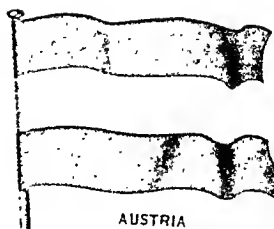
The FLAGS of EUROPE



ALBANIA



ANDORRA



AUSTRIA



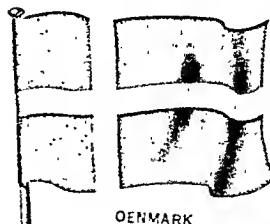
BELGIUM



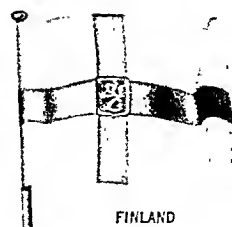
BULGARIA



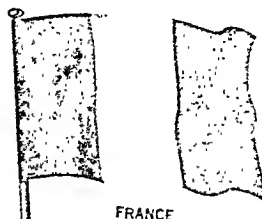
CZECHOSLOVAKIA



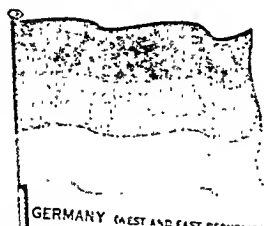
DENMARK



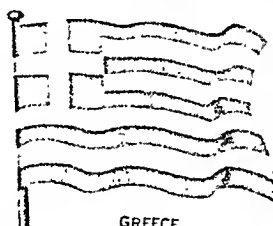
FINLAND



FRANCE



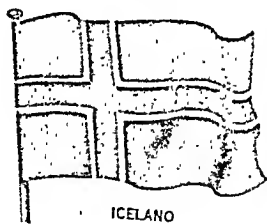
GERMANY (WEST AND EAST REPUBLICS)



GREECE



HUNGARY



ICELAND



IRELAND

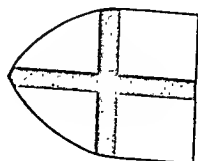


ITALY

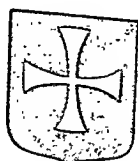


LIECHTENSTEIN

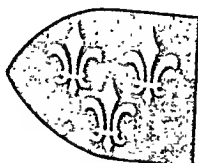
BANNERS of the MIDDLE AGES



BAYONNE



TOULOUSE



FRANCE



GERMANY



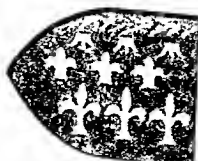
SCOTLAND



GRANADA



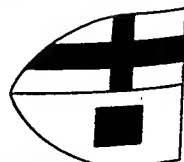
ROME



NAPLES

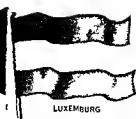


RHOES



TURKEY

The FLAGS of EUROPE



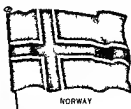
LUXEMBURG



MONACO



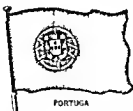
NETHERLANDS



NORWAY



POLAND



PORTUGAL



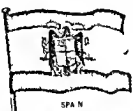
RUMANIA



SAAR



SAN MARINO



SPAIN



SWEDEN



SWITZERLAND



USSR



UNITED KINGDOM



VATICAN CITY



YUGOSLAVIA

BANNERS of the MIDDLE AGES



CLCA



JERUSALEM



DAMASCUS



ALEXANDRIA



MALLORCA



MOROCCO



CHINA



PERSIA



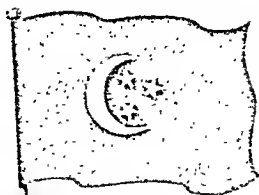
CONSTANTINOPLE



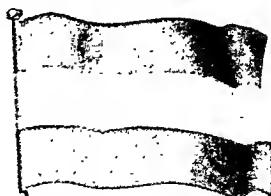
TRANSYLVANIA

FLAGS of AFRICA, ASIA, and the PACIFIC

FLAGS OF AFRICA



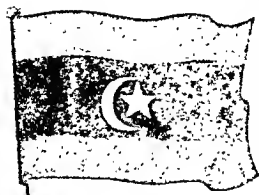
EGYPT



ETHIOPIA



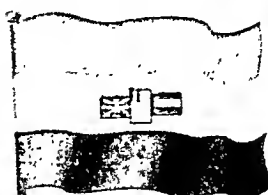
LIBERIA



LIBYA



MOROCCO

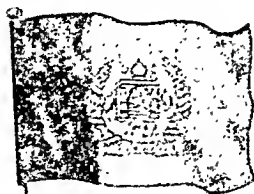


SOUTH AFRICA, UNION OF



TUNISIA

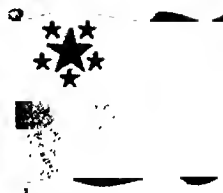
FLAGS OF ASIA AND THE PACIFIC



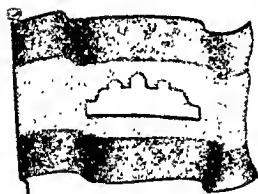
AFGHANISTAN



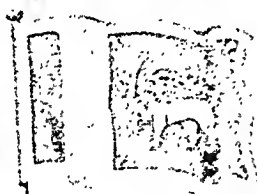
AUSTRALIA



BURMA



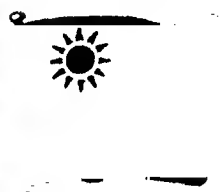
CAMBODIA



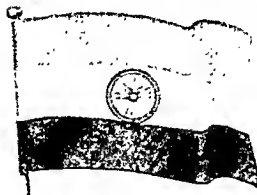
CEYLON



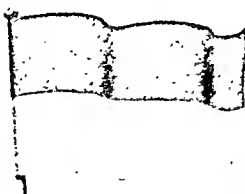
CHINA (COMMUNIST)



CHINA (NATIONALIST)



INDIA



INDONESIA



IRAN



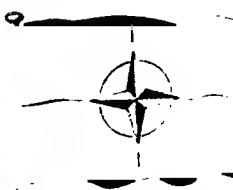
IRAQ



UNITED NATIONS



SHAPE (SUPREME HEADQUARTERS, ALLIED POWERS EUROPE)



NATO (NORTH ATLANTIC TREATY ORGANIZATION)



RED CROSS



RED LION



RED CRESCENT

FLAGS OF THE GENEVA CONVENTION

FLAGS of AFRICA, ASIA, and the PACIFIC



ISRAEL



JAPAN



JORDAN



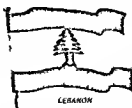
KOREA NORTH



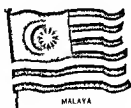
KOREA SOUTH



LAOS



LEBANON



MALAYA



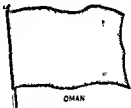
MONGOLIA OUTER



NEPAL



NEW ZEALAND



OMAN



PAKISTAN



PHILIPPINE ISLANDS



SAUDI ARABIA



SYRIA



THAILAND (SIAM)



TURKEY



VIET NAM



YEMEN

FLAGS OF WORLD YOUTH ORGANIZATIONS



YMCA



BOY SCOUTS TROOP



CUB SCOUTS PACK



YWCA

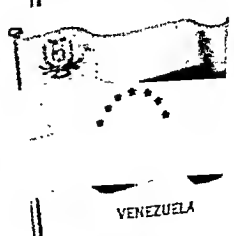
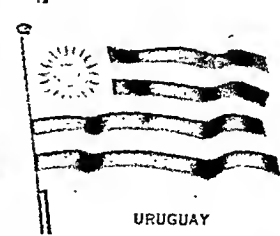
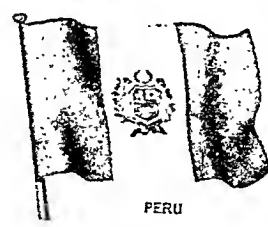
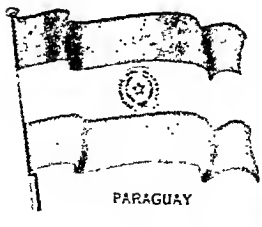
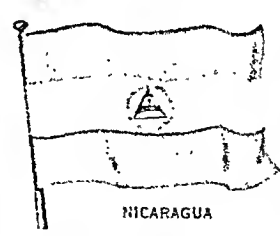
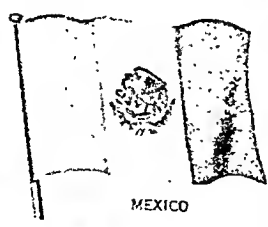
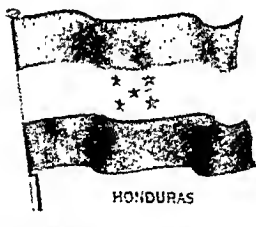
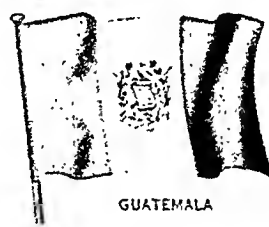
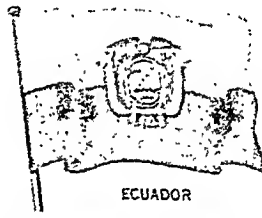
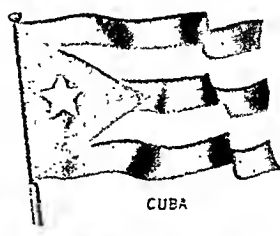
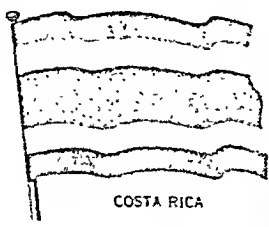
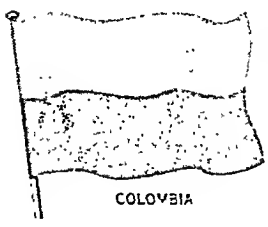
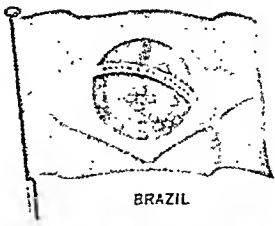
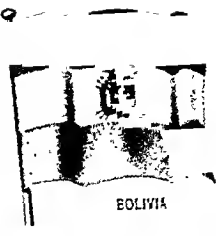
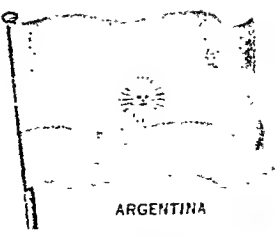
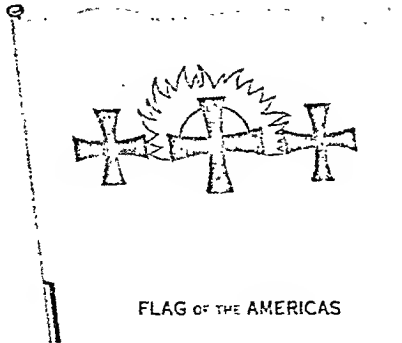


GIRL SCOUTS TROOP

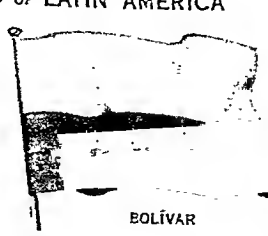
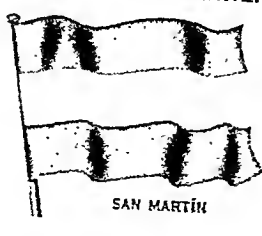


GIRL SCOUTS WORLD

FLAGS of LATIN AMERICA



HISTORIC BANNERS OF LATIN AMERICA



Flags That Fly around the World Emblems of Canada

(These emblems appear on page 131)

Red Ensign Since 1867 the Red Ensign has been accepted as the flag distinctive of Canada. It was officially approved for use outside Canada in 1921 and for general use in 1915. In the canton stands the British Union. On the fly is the Canadian coat of arms representing England, Scotland, Ireland, and France—the chief native lands of the Canadian pioneers. The distinctive Canadian maple leaves stand at the base. (As a member of the British Commonwealth, Canada may correctly fly the Union as its national flag.)

Armed Bearings Adopted 1921. Coat of arms represents Canada and four other nations—England, Scotland, Ireland, and France. The crest is a lion holding a red maple leaf (to symbolize sacrifice) surmounted by royal crown. The supporters are a lion upholding the British Union and a unicorn displaying the ancient banner of France. The motto is translated "From sea to sea."

Provincial Shields

(These devices are used in the fly of the Red or Blue Ensign)

Alberta Adopted 1907. Beneath the cross of St. George are snow-covered Canadian Rockies, green hills, a wide prairie, and a field of wheat.

British Columbia Adopted 1906. In the center of the British Union is a royal crown. The motto, which refers to the radiant sun, is translated "A radiance which never sets."

Manitoba Adopted 1905. Below the cross of St. George a buffalo stands on a rock.

New Brunswick Adopted 1868. Lion stands for English founding, the galley represents maritime culture.

Newfoundland Adopted 1837. In the first and fourth quarters is a crowned lion, in the second and third quarters is a unicorn.

Nova Scotia Charles I of England granted original coat of arms in 1625. It was replaced 1663 by a design of three thistles and a salmon. In 1929 George V re-established the original arms.

Ontario Adopted 1868. Design features sprig of maple leaves below the cross of St. George.

Prince Edward Island Adopted 1905. The top band contains the lion of England. Below are an oak tree and three oak saplings. The motto is translated "The small under [the protection of] the great."

Quebec Adopted 1939. Original arms carried two fleurs-de-lis provincial usage favors three fleurs-de-lis. They represent old French rule of Quebec.

Saskatchewan Adopted 1906. Below the familiar lion are three sheaves of wheat.

Canadian Flags of Today

Blue Ensign Designed in 1870. It flies at the jack staff of ships of the Royal Canadian Navy. (The white ensign flies at the stern.)

Governor General This official is appointed by the ruler of Great Britain. The flag is blue and carries the royal crest of the United Kingdom—a crowned lion standing on a larger crown.

Nova Scotia Flag First used by a firm of Halifax merchants many years before Confederation (1867). It is the blue cross of St. Andrew on a white field. In the center is the Royal Lion of Scotland. Today it flies over the historic Province House and elsewhere in the province.

Quebec Flag The banner of the St. Jean Baptiste society was adopted by order in council of the provincial government of Quebec Jan. 21, 1948. It is a white cross on a blue field with a fleur-de-lis in each corner.

Historic Flags of Canada

Vikings About A.D. 1000 Leif Ericson is believed to have carried the Viking flag to a place he called Vinland (probably present Newfoundland or Nova Scotia). But no permanent settlement was made under this banner.

St. George's Cross John Cabot reached the shores of present Canada, probably Cape Breton Island, in 1497. He was an Italian sailing under the English flag of that time, a white field decorated by the red cross of St. George. This was the English flag until 1806.

France (1524-89) In 1524 Verrazano, an Italian, was the first explorer to carry to Canada the French flag with three gold fleurs-de-lis on a blue field.

France (1589-1763) Some early French settlers brought the plain white flag of the Bourbon kings to Canada. This emblem was sometimes decorated by fleurs-de-lis (see page 128). At the close of the Seven Years' War in 1763 the French flags were officially replaced by British emblems.

St. Andrew's Cross In 1621 King James VI of Scotland (James I of England) granted all the land between New England and Newfoundland to Sir William Alexander of Menstrie (near Stirling). The banner of 'New Scotland' (Nova Scotia) was the white cross of St. Andrew on a blue field. Below the crown is the monogram J R for Jacobus Rex (Latin for James the king).

British Union (1763-1801) After the Seven Years' War ended in 1763 this British Union flew over Canada until it was replaced by the new Union of 1801.

British Red Ensign (1763-1801) Following the Act of Union in 1707 the new nation of Great Britain adopted a second flag. This red emblem with the first Union in the canton was carried by British military forces in North America until 1801.

British Union When the United Kingdom was formed in 1801 the red cross of St. Patrick was added to the old Union flag. This is the present national flag of the United Kingdom.

Flags of Europe

(These emblems appear on pages 132 and 133)

Albania Adopted 1913. In 1930 helmet of Scanderbeg was placed above eagle on flag. Design based on flag of Scanderbeg, an Albanian hero, whose real name was George Castriot (1403-68). Original helmet was gift of Pope Nicholas V in 1448. Communist regime replaced helmet with gold-outlined star.

Andorra Date of adoption uncertain. Blue, yellow, and red stripes once horizontal are now vertical. The national coat of arms is carried on yellow stripe.

Austria Adopted 1921. Design dates to battle in 1193 against Saracens, when Duke Leopold II of Austria and his brother lost all their banners. Leopold

grasped his white scarf by center, dipped ends in blood, and thus produced three stripes.

Belgium. Adopted 1831. Colors said to represent provinces in Confederation of Belgian States in 1790 revolution. Black stands for force, red for victory, yellow for maturity. These are also colors of duchy of Brabant, leader in 1830 revolt against Dutch rule.

Bulgaria. Adopted 1879. White stripe stands for peace, green for forests, red for blood shed for freedom. Ensign has lion and red star next to staff.

Czechoslovakia. Adopted 1920. Blue triangle represents Carpathian Mountains; white and red the historic banner of ancient Bohemia, home of Czechs.

Denmark. One of the oldest of flags. Legend says in 1219, during battle of Reval, the hard-pressed Danish king, Waldemar II, saw cross in heavens and thus acquired strength to defeat the Estonians.

Finland. Adopted 1918. Cross from Swedish flag, shield from old arms of Russia; nine roses back of lion on shield represent nine provinces of Finland. Lion brandishes straight sword used in west and treads underfoot curved scimitar of Orient to indicate that Finland held to European traditions.

France. Many stories are told of the origin of the tricolor, which dates from 1789. One says Lafayette devised new cockade from white of royal family and red and blue colors of Paris. Another version declares tricolor represents the three historic flags of France—blue of Chape de Martin (cloak of St. Martin), red of oriflamme, and white of Bourbons. Chape de Martin is supposed to be the original cloak St. Martin divided with a beggar at Amiens. When seat of French government was removed to Paris, blue flag of St. Martin was supplanted by scarlet oriflamme of the Parisian St. Denis. White flag of Bourbons originated with Huguenots and became royal ensign when Henry III came to throne. A third account says tricolor is copied from shield of Orléans family as it appeared after Philippe Egalité removed fleurs-de-lis.

Germany. Following the surrender of Germany in the second World War, the Nazi swastika banner was outlawed. In 1949 Western Germany chose the flag of the old Weimar Republic as the emblem of the Federal Republic of Germany. The Communist-dominated East German government in 1949 likewise chose the tricolor of black, red, and gold for its German Democratic Republic.

Greece. Adopted 1822, at beginning of revolution which ended Turkish rule. Chryso, daughter of an early revolutionist, made the first flag for Greek patriots, a white Greek cross on a plain blue field. It was carried during the Greek War of Independence. Then the Greeks placed the design of Chryso's flag in upper left corner of national flag and put four white bands across blue field for four countries which helped them—England, Russia, France, and the United States. Others say stripes stand for nine stripes on gold shield of Achilles, or for nine Muses, or that they represent the nine syllables in the Greek words for "Liberty or Death."

Hungary. In 1949 Hungary proclaimed itself a People's (Communist) Republic and redesigned its flag. It retained the horizontal stripes of red, white, and green but chose a new coat of arms. A wreath of wheat surrounds a hammer crossed with a head of wheat on a sky-blue background. At the top is a rising red star, common to flags of nations under Communist party leadership. The tricolor of red, white, and green is repeated in a horizontal band at the base.

Iceland. Authorized 1915 by the king of Denmark. Resembles flags of Denmark, Finland, Sweden, and Norway.

Ireland. Adopted 1922 but in use since 1916. Orange is the color of the old Orangemen, loyal to William of Orange when Irish revolted. Green is the old color of the Irish clans. White is for peace.

Italy. Red, white, and green flag first flew at Modena in 1797 as banner of Cispadane Republic. In 1805, when Napoleon grouped north Italian provinces into a kingdom, he adopted this flag. It appeared again in 1848, when King Carlo Alberto of Piedmont, of the House of Savoy, tried to free Italy. He added the arms of Savoy. When Italy was liberated in 1870, Garibaldi carried this flag. Victor Emmanuel II added a crown above the arms. Arms and crown were removed when Italy became a republic in 1946.

Liechtenstein. Origin of flag uncertain. Colors believed to be those of its two lordships, Schellenburg and Vaduz. Flag is often flown vertically or at an angle so that crown is upright.

Luxemburg. The Congress of Vienna, in 1815, assigned Luxemburg to the Netherlands. In 1890, when Queen Wilhelmina ascended the Dutch throne, Luxemburg passed to a collateral branch, the dukes of Nassau. It retained the Netherlands colors, which matched those on a 13th-century Luxemburg seal.

Monaco. The colors of this simple flag were taken from the arms of the House of Grimaldi, which came to power in the 10th century.

Netherlands. Orange, white, and blue, colors of William of Orange, Dutch hero, served as Dutch flag for years. Orange, hard to distinguish at a distance, was changed to red in 17th century.

Norway. Adopted 1821. Norway was for many years united with Denmark. When Napoleonic wars ended, Norway was given to Sweden. Norwegian sailors, not wishing to sail under the Swedish flag, took their old Danish flag and added a blue cross.

Poland. Adopted 1927, but flown since 1919. This white and red flag was made by Napoleon for duchy of Warsaw. Colors, red and white, go back to old Polish banner of Lech, a white eagle on red field. Legend says the brothers Czech and Lech set out from Yugoslavia to find a home for their people. Czech founded Prague. Lech went on, saw a white eagle in a tree, took it as an omen, and founded Warsaw.

Portugal. Adopted 1910. Silver shield with five blue shields in form of cross represents triumph of Alfonso I over five Moorish princes in battle of Ourique. Each blue shield has five silver disks, representing five wounds of Christ. Around shield is red border with seven golden castles, added by Alfonso III in 1253-54 on establishing present national boundaries. Sphere and ribbons of gold commemorate Prince Henry the Navigator. Green stands for the Knights of St. Benedict of Aviz, red for revolution (1910).

Romania. In 1848 Rumanian revolutionaries carried a flag with colors of early settlements: blue for Moldavia, yellow for Oltenia, and red for Walachia. In 1859 Rumania was united under the present three colors in its national flag. It became a People's Republic in 1947 and in 1948 revised its coat of arms. At the base is a tricolor ribbon bearing the initials R P R for Republic Populăra Romăna (People's Republic of Rumania).

Saar. Adopted 1947, by Article 61 of Saar Constitution. Blue and white represent county of Saarbrücken-Ottweiler and the former Palatine portion of the Saar

territory red symbolizes the Metz district. The colors also recall the flag of the French Revolution (which became the national flag of France).

San Marino Date of adoption uncertain. Coat of arms represents nation's geography and government. Staff is usually striped blue and white spirally.

Spain Flag of republic adopted after overthrow of kingdom in 1931. Colors of red and yellow are those of arms of King Ferdinand. Coat of arms (adopted 1938) mounted on eagle of St. John with scroll bearing words *Una Grande Libre* (One grand free).

Sweden When Sweden was part of Denmark King Christian II oppressed the people. Gustavus Vasa son of a Swedish noble led a small army to Falun. There he seized some Danish merchants' bales of blue and yellow silk and from these the Swedes made a flag in 1521. Flag became official in 1815.

Switzerland League of three forest cantons formed in 1291 flew a plain red flag. In 1300's league grew to seven cantons united under a new flag: the white cross of Crusaders on the old red field. In 1480 present flag with white cross was adopted by all troops of Swiss Confederate States and became the accepted national emblem.

U.S.S.R.—Union of Soviet Socialist Republics (Russia) Flag adopted from banner of Communists after revolution of 1917. Red stands for revolution and the common humanity of all peoples. Sickle represents agricultural workers and hammer industrial workers. Star is symbol of authority vested in central government of U.S.S.R. Each of 16 Soviet republics has its own flag.

United Kingdom of Great Britain and Northern Ireland The red cross of St. George on white field was first flag of England. Legend says it originated when St. George rescued a princess from a dragon. dipped his lance in the dragon's blood and traced a cross on his white shield. Richard I the Lion Hearted made the

banner the flag of England during the Crusades. In 1606 three years after James VI of Scotland became also James I of England the Scottish emblem, the cross of St. Andrew was added. According to tradition when St. Andrew one of the Twelve Apostles was crucified he asked to die on a cross shaped like the letter X. This diagonal white cross was seen in blue sky during a battle in 940 between Scots and Saxons and Scotland took a white cross on a blue field for banner. The cross of St. Patrick was added in 1801 after Ireland had been included in the United Kingdom. St. Patrick's cross is two red diagonals on a white field. Some heraldry authorities hold that this badge originated with the Norman house of Gerald who entered Ireland in 1169. The British flag is sometimes called the Union Flag or the Union Jack.

Vatican City State Authorized 1929 when treaty between Italy and the pope was signed. Similar to old papal flag of gold and silver. Crossed keys refer to papal power and giving of keys to Peter by Christ (Matt. xvi. 19). Tripartite crown represents papal authority standing for royal imperial and sacerdotal powers of pope according to some authorities. First crown or cinct mentioned in life of Paschal II 1097-1113. Second cinct added by Boniface VIII 1294-1303. Third cinct added by popes of Avignon in 1315 or 1316. Benedict XII adopted present form in 1342. Legend is *Stato della Città del Vaticano* (State of the City of the Vatican).

Yugoslavia Flag was first proclaimed 1921 by Constitutional Assembly although in use earlier. First Serbian flag designed late in 18th century had horizontal red blue and white stripes later changed to blue white and red. Bosnia Croatia and Slovenia also had flags of red white and blue and accepted these colors for the new nation. A red star was added to the white stripe in 1942.

Banners of the Middle Ages

(These emblems appear in bottom rows on pages 132 and 133)

France A French friar born in Spain in 1304 whose name is now unknown compiled the first representation of the flags of all nations. He traveled as far east as Java and left an illustrated manuscript which he called *Book of Knowledge of All the Kingdoms Countries and Lordships* that there are in the World and of the Emblems and Arms of Each Country and Lordship also of the Kings and Lords Who Govern Them. The medieval flags pictured are from the friar's work and the following accounts of them are excerpts from his manuscript.

Bayonne The lord of this Bayona [Bayonne France] has for his flag white with a cross red. (At the time of his visit the city was ruled by England and the flag therefore was the cross of St. George.)

Toulouse The noble city of Tolosa [Toulouse France] where liberal arts are studied and the lord of this Tolosa has for his sign a red flag with a cross [called a *formée*] of gold.

France Know that the kingdom of France borders on the Mediterranean where there is a city called Narbonne and on the Alps of Alsace and on the coasts of Flanders and all the coasts of Gasconia [Gascony] to the Pyrenees. The king of France has three fleurs-de-lis of gold.

Germany I crossed a great river which they call Rhine [the Rhine] which passes by Colonia [Cologne] a

great city of Germany. The Emperor of Germany has for his device a flag—yellow with a black eagle crowned.

Scotland The king of this Escocia [Scotland] has for his device a red flag with three long lions of gold.

Granada (Spain during Moorish rule) The device of this king is a red flag with Arabic letters of gold such as Mahommed their prophet bore.

Rome The devices of Rome are a red flag with a gold bar on which are letters (S P Q R—Senatus Populusque Romanus meaning the Roman senate and people).

Naples The king of Naples has for his device a purple flag with gold fleurs-de-lis for he is of the house of France. Above is a red ship which they call a label.

Rhodes These Knights of Rhodes banner seen by the friar when he visited Rodas island formerly appeared in the shield of the flag of Italy. It is the emblem of the Knights of the Order of the Hospital of St. John of Jerusalem later called the Knights of Rhodes and the Sovereign Order of the Knights of Malta.

Turkey A very rich land well supplied with goods. (The flag combines the English cross of St. George with the red square of Persia.)

Cilicia (Lesser Armenia) (Now a part of Turkey this was once an independent Christian state. Its red crosses and fleurs-de-lis show its attachment to the West.)

Jerusalem. "Know that in this Suria [Syria] is the city of Iherusalem [Jerusalem], which was sanctified by the holy temple of Salamon [Solomon], built there, and was consecrated by the blood of Ihesu Christo [Jesus Christ] . . . The device of this province is a white flag with red crosses." (Modern authorities know these red crosses were not the arms of Jerusalem, which are five gold crosses on a silver flag. They stand for the five wounds of Christ.)

Damascus. "Near this Damasco [Damascus] flows the river Eufrates [Euphrates]. The king has a yellow flag with a white moon."

Alexandria. "The king of this Alexandria has for his device a yellow flag and in the middle a black wheel in which is a lion."

Mallorca or Majorca (largest of the Balearic Islands). "The king has for his device a flag with bars vert [green] and sable [black]."

Morocco. "The King of Marruccos [Morocco] has for his device a red flag with a chessboard black and white."

National Flags of Africa, Asia, and the Pacific

(These flags appear on pages 134 and 135)

Flags of Africa

Egypt. Adopted 1923. Tradition dates green color from A. D. 626, when Mohammed unfurled his green turban as flag. Sentiment has suggested white stands for peace, green both for the prophet and the spring green of Nile's banks, three stars for Turks, Arabs, and Egyptians, and moon for lunar calendar.

Ethiopia. Used since 1894. Green stands for fertility of land, yellow for zeal for country, red for blood shed in its defense.

Liberia. Adopted 1847, when Negro colonists from United States established Republic of Liberia. Stripes represent 11 signers of Liberian independence declaration.

Libya. Became a national flag when Libya became independent Dec. 24, 1951. Stripes represent the three states of Libya—red for Fezzan, green for Tripolitania, and black (with crescent and star) for Cyrenaica.

Morocco. The ancient flag of Morocco carried the Mohammedan crescent on a red field. With the passing of Turkish influence the green Solomon's seal replaced the crescent in the national flag. This is the flag of the entire sultanate comprising French Morocco, Spanish Morocco, and Tangier.

South Africa, Union of. Authorized 1927. In white stripe is British Union, an old flag of Orange Free State, and Transvaal vierkleur ("four-color"). Stripes from old Dutch flag of orange, white, and blue.

Tunisia. The red crescent and star on a white disk is an old Mohammedan device. Tunisia is a French protectorate.

Flags of Asia and the Pacific

Afghanistan. Adopted 1929. Black stripe is for the past, red stripe for the blood shed for independence, green stripe for hope for the future and also for traditional color of Mohammedans. Center device is a mosque enclosed by two heads of wheat.

Australia. Adopted 1908. Ensign has British Union in the canton. Five small stars represent Southern Cross; seven-pointed star stands for six states and federal territories. Official flag is the British Union.

Burma. Flag first raised 1948. The large star in the dark blue canton represents the nation. The five smaller stars stand for its Burmese, Karens, Shans, Kachins, and Chins.

China. "They call this emperor Gosman Imperator Morroy, and Grand Can, Lord of the East. His device is a gold flag and in the middle an emperor seated, in white cloth, with an imperial crown on his head, in one hand a Turkish bow, in the other a golden apple."

Persia. "The Persians are wise and very well versed in all the sciences. They have learned men with a profound knowledge of the stars. The Emperor of Persia [now Iran] has for his device a yellow flag with a red square in the middle."

Constantinople. The friar wrote of the capital city of Byzantium: "The Emperor of Constantinople has for his device a flag quarterly," first and fourth quarters, red second and third, silver. Also represented are four crosses and four links of chain.

Transylvania. "I went to the kingdom of Silvana . . . the Greeks called it Horgiml [Transylvania]. It is encircled by two great rivers—the Turbo [Dniester] and the Lusim [Dnieper]. The king has for his device a green flag with a red scimitar."

Combodio. This flag took its place with other national flags in 1948 when Cambodia became an independent state within the French Union. The red stripe contains the silhouette of the temple of Angkor-Vat.

Ceylon. Adopted 1948. Sinhalese (Ceylonese) lion holds a saber in its right paw. Yellow symbols in the corners are sacred bo leaves. Saffron stripe represents the Tamils; green, the Moors.

China (Communist). Flag of the Communist government (the "People's Republic of China") adopted 1949. Large yellow star symbolizes Communist party leadership. Four smaller stars represent workers, farmers, petty bourgeoisie, and national capitalists.

China (Nationalist). Adopted 1928. White sun stands for justice; blue for cleanliness; red for either revolution or ancient China. This is the flag of the Nationalist, or Kuomintang, government.

India. Adopted 1947. Saffron stands for courage and sacrifice, white for peace and truth, and green for faith and chivalry. In center of flag, Asoka's wheel is the Dharma Chakra, or wheel of law, the symbol of India's ancient culture.

Indonesia. Adopted 1949. Historically flag represents the spirit of freedom and justice. According to folklore, it was the flag of the Modjopahit Empire between A.D. 800 and 1400. Its present-day history dates from 1929 at the height of the Indonesian National Movement. (Flag is the same as Monaco's.)

Iran (Persia). The national flag adopted in 1933 has only three horizontal stripes—green for Mohammedanism, white for peace, and red for valor. But the flag most often used is the government flag which has a lion holding a scimitar, and a sun on white stripe. Lion is symbol of Babylon, sword represents a conquered province, sun is historical symbol of ancient Persia.

Iraq. Adopted 1920. Some say that the two stars stand for Iraq's Arabs and Kurds. Others say that stars represent the Tigris and Euphrates rivers.

Israel. Adopted 1948, first displayed in 1898 at Second Basel Congress. Six-pointed star has been symbol of Judaism for at least 2,000 years. Colors are taken from the Jewish prayer shawl, the *tallith*.

Japan. National flag was authorized by General MacArthur in 1949. Flag was carried by the Japanese

army in the second World War. A second well known Japanese flag the ensign has a sunburst design—a red sun with 16 extended rays on a white field. There is no authentic account of the origin of either flag.

Jordan Hashemite Kingdom. Adopted 1947. Symbolism of colors and seven pointed star is uncertain. King Hussein (ruled 1916-25) of Hejaz devised one star for present Jordan, two for Iraq and three for Syria.

Korea North Flag of the Democratic Korean People's Republic adopted when Communist state was formed in 1948. Red and blue colors taken from old flag of Korea (Chosen) in use before 1910. Large red star common symbol of a Communist nation.

Korea South Flag of Republic of Korea adopted when ROH became independent in 1948. Circular yang and um device (Tai Guk) symbolizes any two complementary objects of nature such as male and female or day and night. Four trigrams represent philosophical ever changes permitting of many interpretations. This was the fly of the old Korean (Chosen) nation.

Laos In 1949 Laos became an independent state within the French Union. The three-headed elephant signifies that Laos is the land of thousands of elephants.

Lebanon Adopted 1943. Cedar is traditional tree of nation. In ancient times Hiram of Tyre supplied cedars from Lebanon for Solomon's temple.

Moloya Federaton Adopted 1950 by this British protectorate. Eleven stripes signify nine states and two settlements.

Mongol Outer The flag of the Mongolian People's Republic incorporates Buddhist symbols in the red stripe next to the staff. From top to bottom the symbols are: star, flame, sun, moon, triangle, bar, two fish in a circle, another bar and another triangle. The two pillars represent boundaries.

Nepal Strangest of flags is the dove-tailed banner of Nepal with two pie-faces of sun and crescent moon symbols which a gnify nation shall be as everlasting as the sun and the moon.

New Zealand Blue ensign with Southern Cross represented by four red stars was first used at beginning of 1900s. The official national flag is the British Union which is carried in the canton on the ensign.

Oman Flag is emblem of independent sultanate sometimes called Muscat and Oman. Origin of flag not certain. It may be taken from the red field of Turkish flag (Mohammed II carried plain red flag until 1453).

Pakistan Flag adopted 1947. Green is ancient color of Mohammed's turban. Crescent and star are also historical Moslem symbols.

Philippine Islands Flag first carried in rebellion against Spain in 1896. Adopted 1970 flag became national emblem. 1946. Sun's rays represent first eight provinces to rebel against Spain. Stars signify three great geographical divisions—Luzon, Visayan, Mindanao.

Saudi Arabia Flag adopted from old Arab emblem in 1937. Green is ancient color of prophet's turban. Arabic inscription is motto of Mohammedans meaning "There is no God but God and Mohammed is his prophet." Crossed sabers represent military quality of Moslem faith.

Syria Adopted in 1932. Flag is modification of Hashemite banner unfurled by King Faisal in 1920. Green stands for Omayyad caliphate, white for Abbassid dynasty and black for early Islamic era. Stars represent vilayets of Damascus, Aleppo and Deir ez Zor.

Tai land (Siam) National flag adopted in 1899 had splendid white elephant on a red field. In 1917 elephant

(sacred in Thailand) dropped because inept flag makers distorted likeness of animal. Flag changed to one of red and white horizontal stripes. In 1937 King Rama VI introduced blue center stripe.

Turkey Adopted 1928. In 339 B.C. Philip of Macedon besieged city later called Byzantium. His men scaled the walls in the dark and defenders unable to distinguish friend from foe were about to be overcome when suddenly the crescent moon appeared. By its light Byzantines saved city and crescent became badge of Byzantium or Constantinople (now Istanbul). When Mohammed II of Turkey took Constantinople in A.D. 1453 he added crescent to his plain red flag. Turks copied star from shield of Richard I the Lion Hearted not realizing it was a Christian symbol, the star of Bethlehem. Others say it is the morning star, Al Tarek.

Viet Nam Adopted 1948. Stripes represent Tonkin, Annam and Cochinchina, the three principal divisions of the nation.

Yemen Adopted 1927. Stars represent five geographic divisions of nation, five dogmas of Islam and five times a day that prayers are recited by the faithful. Saber and red color are popular Arab devices.

International Flags

United Nations Adopted by General Assembly Oct. 20, 1947. Centered in light-blue field is white UN emblem, a polar map of the world embraced by two olive branches. Authorized proportions are 2 by 3 or 3 by 5. Security Council in 1950 authorized UN flag to be flown by United Nations military forces in Korea.

Supreme Headquarters Allied Powers Europe Adopted 1951. General Dwight Eisenhower helped design flag. Twelve silver fronds represent charter nation of NATO. SHAPE motto is translated "Vigilance is the price of liberty."

Nothin' at All Cost Treaty Organzaton Adopted 1953. Compass device chosen to illustrate that NATO nations are on the right road—the path of peace. Circle represents unity of NATO nations.

Flags of the Geneva Convention In 1864 14 nations signed the Geneva Convention on agreeing to protect societies organized to care for war wounded. They adopted the flag of Switzerland with the colors reversed. Iran, a Mohammedan nation, uses its historic red lion on a white field. Mohammedan lands of Turkey and Egypt adopted the red crescent as a piece of the red cross.

YMCA The flag of the Young Men's Christian Association on carries initials on a bar. The points of the triangle represent the spirit, mind and body.

YWCA The flag of the Young Women's Christian Association on carries its initials on a blue bar. The triangle symbolism is the same as that of the YMCA. It came into use during the first World War.

Boy Scouts Troop Flag Center device is badge of Boy Scouts of America (BSA). The number of the troop is carried in white on the red stripe, the location of the troop is named in red on the white stripe.

Cub Scouts Pack flag Center device is badge of the Wolf Pack (for boys 8 years of age). Pack number is carried on yellow stripe, sponsor's name on blue stripe.

Girl Scouts Troop Flag The green and gold Girl Scout badge is centered in the fly. Blue stripe contains the troop number, the white stripe the location.

Girl Scouts World Flag Two stars in leaves of trefoil symbolize Girl Guides and Girl Scouts. Promise and Law. Banner may be used as troop flag by adding vertical lettering of troop number at the left and location at the right.

National Flags of Latin America

(These flags appear on page 136)

Flag of the Americas. First hoisted Oct. 12, 1932, in Montevideo. Adopted by 21 American nations. Three wine-colored crosses symbolize ships of Columbus. Bronze sun of Incas represents American Indians. Flag usually flown on Pan American Day, April 14.

Argentina. Adopted 1816; designed 1812 from colors of Patricios, Buenos Aires regiment that repulsed British in 1807. Sun indicates revolution of May 1810.

Bolivia. Adopted 1825 and revised 1888. Red, gold, and green stripes represent animal, mineral, and vegetable kingdoms. In coat of arms, Mount Potosí symbolizes mineral wealth; wheat and breadfruit tree, agricultural wealth; the alpaca, the value of its wool; and the rising sun, the future. Smaller flags show love of country, while crossed cannons and rifles signify military might. Above are laurel, olive wreath, and condor. Nine stars on bottom rim are for government departments.

Brazil. Adopted 1889. Green field represents vegetable kingdom; yellow diamond, mineral kingdom. Blue circle shows heavens at Rio de Janeiro with Southern Cross at meridian. Legend means "Order and progress." Stars represent 20 states and capitals.

Chile. Adopted 1817, by Gen. Bernardo O'Higgins, liberator and dictator of Chile, who chose colors from United States flag and added silver star used on pennants of Indian tribes in Chile.

Colombia. Designed 1806 for Republic of Greater Colombia, which then included Panama. Red and yellow represent colors of Spain, also blood of patriots and mineral wealth; blue represents ocean waters on either side of Isthmus of Panama. Colors taken from Bolívar's flag.

Costa Rica. Adopted 1848. Five stripes stand for the five provinces. The red stripe is also for liberty.

Cuba. Adopted 1906. First used by Gen. Narciso López when he landed at Cardenas May 19, 1850, in unsuccessful attempt to free Cuba. Flown in revolutions of 1868 and 1895 and during American occupation. Known to Cubans as "La Estrella Solitaria" (The lone star). Star borrowed from the old Texas flag.

Dominican Republic. Adopted 1844. The coat of arms appears at center of white cross, bearing a second cross which signifies redemption from slavery; a book of Gospels; and an inscription "Dios, Patria, Libertad" (God, country, liberty).

Ecuador. Adopted 1900. Colors taken from flag of Simón Bolívar. Arms in center show sun rising over Mount Chimborazo, river with steamship, and condor.

El Salvador. Adopted 1912. Old flag of Central American Federation. Coat of arms contains the motto of nation, "God, union, liberty."

Guatemala. Adopted 1871, restoring colors of 1823. Scroll on coat of arms reads "Libertad, 15 de Setiembre, 1821" (Liberty, 15th of September, 1821). Above is a quetzal, the national bird.

Haiti. Red and blue stripes adopted 1803 from French Tricolor; red for mulattoes, blue for Negroes. Coat of arms added in 1807. Motto means "Union makes strength."

Honduras. Adopted 1866. Flag of old Central American Federation, with five stars added for each member.

Mexico. Adopted 1917. Green means independence; white, purity of religion; red, union of Spanish and Mexican blood. Coat of arms refers to old legend of founding of Mexico City, formerly Tenochtitlán, by

migrating Aztecs in 1325. Words "Estados Unidos Mexicanos" mean United States of Mexico.

Nicaragua. Adopted 1903, but design dates to flag of Central American Federation of 1823. Coat of arms shows five volcanoes for five nations of Nicaragua. Guatemala, Honduras, Costa Rica, and El Salvador.

Panama. Adopted 1903. Red and blue represent two political parties; two stars said to stand for Panama and Colón, cities at two ends of Panama Canal.

Paraguay. Adopted 1842. The dictator José Gaspar Rodríguez Francia, 1814-40, great admirer of Napoleon, introduced colors of France. National shield in white stripe shows five-pointed gold star and wreath of palm and olive branches. On reverse of flag is circle with lion seated at foot of pike bearing liberty cap, and the motto "Paz y Justicia" (Peace and justice). Only national flag to have distinctive reverse.

Peru. Adopted 1825. Coat of arms in center shows llama on blue field, cinchona tree on white field, and cornucopia pouring gold coins on red field. These symbolize riches of animal, mineral, and vegetable kingdoms.

Uruguay. Adopted 1928. Stripes stand for nine political departments. Sun is "El Sol de Mayo" (The sun of May), symbolizing awakening to independence.

Venezuela. First flown 1806; officially decreed 1853. Designed by Gen. Francisco de Miranda, with gold to represent golden new opportunities of America, red to represent Spain, and blue for Atlantic ocean between. Seven stars are for seven original states.

Historic Banners of Latin America

Spanish Bourbons. This was the flag flown by the Spanish rulers in Mexico during the early 1800's. It flew until Mexico achieved independence in 1821.

San Martín. "The Liberator of the South," General San Martín, carried this banner in helping to free Argentina from Spanish rule. Later he also led successful revolts by Chile and Peru.

Bolívar. In 1822 Simón Bolívar replaced San Martín as leader of the Latin American revolution against Spain. Under his banner final freedom was won for Peru and for Venezuela, Colombia, and Bolivia.

New Granada. When the old Republic of Colombia broke up in 1829 a confederation of new states was formed under the name, New Granada. This was their flag until the present Colombian flag was adopted.

Editor's Note—The preceding illustrations and descriptions of flags have resulted from original research and the careful checking of information from embassies, foreign countries, heraldry experts, and custodians of archives. It was particularly necessary to weigh carefully the data concerning early American flags. These were designed and made under circumstances of national excitement, when there was little thought of record keeping.

Many reproductions of flags are inexact because of the difficulty and expense of representing the varied and sometimes unusual colors appearing in flags. We have made every effort to reproduce the true colors and designs. In cases of flags which are habitually manufactured contrary to their specifications, or of flags whose proper design or color is in doubt, we have been guided by popular use, preference, or tradition.

A SCARLET FLAMINGO AND ITS CURIOUS NEST



The flamingo is a beautiful scarlet color, somewhat paler on the underparts. The primary and secondary wing feathers are black. The bill is red with a black tip. The bird makes a curious nest, dug in mud 1 cm. out to two feet high. It is shaped like a tiny volcano. In the crater the female lays a single chalky white egg.

FLAMINGO A curious combination of beautiful coloring and ungainly form is presented by the flamingo. A man who saw a flock of the birds on the wing compared it to a gigantic brilliantly rosy scarf waving to and fro in mighty folds as it flies away. But a flamingo viewed at close range is anything but graceful.

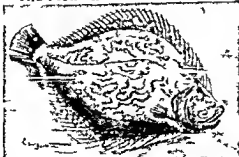
It stands between 5 and 6½ feet high on amazingly long thin legs. The body is bumpy and about 4 feet long. The slender neck curves upward like a big letter S and ends in a small head with a flat down-curved beak. The bird flies with neck and legs outstretched like a crane. The call of the adult is a goose-like honking.

The bird feeds exclusively on mollusks of the genus *Cerithium*. It gets them by plunging its head into mud and water, then twisting it upside down and using the upper beak as a scoop. It forces out sand and mud taken in with the food through ridges along the sides of the beak.

Flamingos live in tropical countries. There are six species. The American scarlet flamingo (*Phoenicopterus ruber*) is becoming increasingly rare. It nests in the Bahamas, Cuba, and Haiti, and along the coasts of Central and South America from Yucatan to Brazil and Chile. It winters in the same regions. Other species are native to tropical Africa and Asia.

Flamingos nest in colonies on coastal salt mud flats. The female lays a single egg and her mate helps her hatch it in about 30 days. The young are covered with white down. At first the bill is straight; it takes a downward curve gradually. (For picture in color see *Birds*.) In zoological gardens flamingos often lose their bright colors, but these can be restored by feeding them the proper food. The most famous collection of captive birds is the large breeding colony on the Hialeah Park race track near Miami, Fla. **FLANDERS** In the Middle Ages Flanders extended along the North Sea southward and westward from the River Scheldt to the Strait of Dover. Parts of Flanders are now included in the Netherlands and parts in northern France, but the greater part lies in Belgium. There about half the people still speak Flemish, a language similar to Dutch (see *Belgium*).

THE FISH THAT CHANGES SHAPE



The European flounder swims up and in early life but as its side when grown. Thereupon a month or so and the under eye comes to the top giving it a twisted head.

FLATFISH Among the most remarkable of all fishes are the flatfish. They include such important food fishes as the halibut, turbot, plaice, sole, and various flounders.

These odd creatures lie on the bottom of the sea and swim on either the right or the left side instead of on the belly as most fishes do. As a result of this habit their eyes lie on the upper side of the body and the mouth is twisted toward the under side.

Biologists believe that in bygone ages ancestors of these fish swam upright. Gradually the tribe took to living on the sea bottom. But this left one eye buried in the sand and mud. Gradually, through ages of slow evolution, the under eye migrated to the upper side of the head.

The Change from an Upright to a Sideways Existence

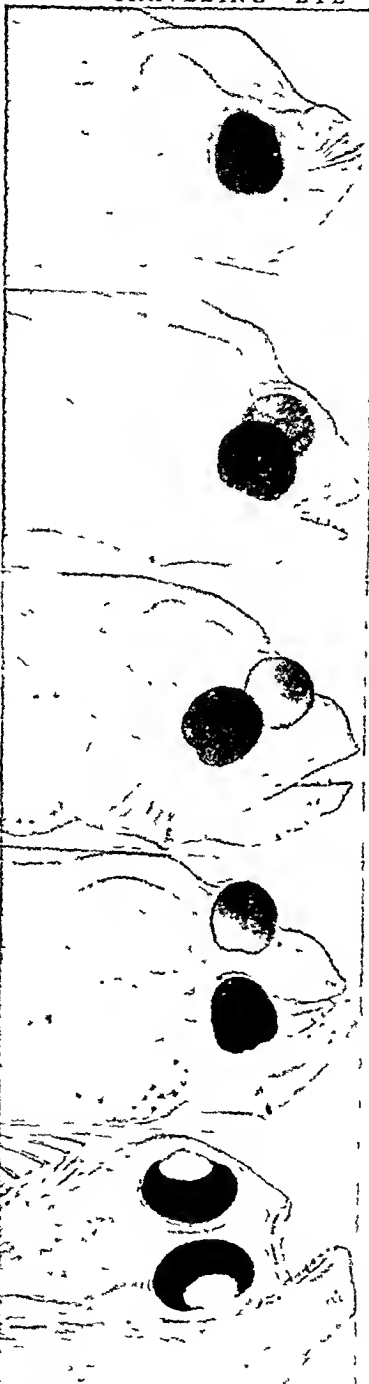
Today this evolutionary history of the group is repeated in the early life of each individual. The eggs float in the sea and are hatched in a few days. The newly hatched larvae swim upright near the surface of the sea and have symmetrical heads with the eyes on either side.

Within three days (in the case of the American flounder) the fish begins to turn sideways and sink toward the bottom of the sea. At the same time one eye moves to the upper edge of the head and finally to the opposite side. There it lies near the other eye, but higher and farther forward. Meanwhile, a bar of cartilage in the head has become absorbed so that no obstacle lies in the path of the migrating eye.

Some flatfish spend all their time feeding on shellfish and other creatures that live in mud and sand, and the mouth becomes twisted. The sole has its mouth twisted almost entirely to the under side. The plaice has more teeth and stronger jaws on the under side than on the upper. The halibut is more active and often leaves the bottom to catch other fish. Its mouth has upper and lower jaws about the same size, and the teeth are equally developed on each side of the head.

Flatfish offer amazing examples of protective coloration (see Protective Coloration). The under side is white. The upper side takes on the color and mottling of any surface where the fish may lie. Experiments in aquariums have shown how well flatfish can imitate their background. The plaice, for example, normally has bright orange-red spots. But if it moves over gravel composed of white pebbles, the spots turn white.

THE "TRAVELING" EYE



The flatfish starts life swimming upright. As it grows, it turns sideways and sinks to the bottom of the sea. Since an eye buried in the sand and mud would be useless, the eye on the under side developed the remarkable ability to move across the top of the head and over to the upper side. These pictures show the under eye moving into position near the upper eye.

Flatfish are fringed from head to tail with fins. When they move about on the sea floor they use these fins to obtain a grip on the ground.

Kinds of Flatfish

There are about 500 species of flatfish, belonging to the order *Heterosomata*. Many are highly prized as food. One of the most important is the halibut (see Halibut). It is the largest of the group. It may weigh several hundred pounds. The various flounders also are commercially valuable (see Flounder). The best known of European food fishes is the English sole. The average sole weighs about one pound, but it may weigh up to nine pounds. No member of the sole family (*Soleidae*) lives in American waters. The "fillet of sole" in American restaurants is usually some kind of flounder. The turbot (family *Bothidae*) is another European food fish which does not occur in America.

The plaice or dab (*Hippoglossoides platessoides*) is a flounder commonly caught along the Atlantic coast. "Sand dab" is a popular name given to several different flatfish of the Atlantic and Pacific coasts. The Pacific coast sand dab (*Citharichthys sordidus*) ranges from British Columbia to Lower California. It is taken in greatest quantity in the San Francisco area and is important in the fresh fish market. Another sand dab, also called windowpane fish (*Lophopsetta aquosa*), is so thin that it is transparent. It can be eaten, but fish markets do not handle it because it is too small. (See also Fish.)

FLAX. The woody stem of the flax plant contains the long, strong fibers that make linen cloth. People have raised flax ever since the Egyptians learned how to use this fiber more than 5,000 years ago. Today flax is also grown for its seeds. Pressing and grinding flax seeds produces linseed oil and leaves an oily meal. Manufacturers of paints, varnishes, printer's inks, oilcloth, linoleum, and patent leather use the oil. Farmers buy the meal for fattening their cattle.

FLAX IN BLOOM AND A BUNDLE OF STRAW

The best fiber and the best seeds cannot be obtained from the same kinds of plant. Different types have been developed for each purpose. Fiber flax grows tall and has few branches. It needs a short cool growing season with plenty of rainfall evenly distributed. Otherwise the plants become woody and the fiber is rough and dry.

Seed flax grows well in places that are too dry for fiber flax. The plants are lower and have more branches. The leaves tend to be broader. Thus they can absorb more sunlight. This helps the plants to make more food and thus to produce more seeds. Flax takes less food from the soil than many farm crops do. Weeds and disease are its enemies. To protect it from these farmers rotate flax with other crops.

To harvest fiber flax farmers pull the plants up by the roots because cutting injures the fibers. Flax pulling machines are used unless labor for hand pulling is very cheap. The pulled flax is tied in bundles and left in the field to dry. When dry it is shipped to a mill known as a scutching mill.

Workers at the mill pass the flax through revolving rollers to remove the seeds. Next they ret the flax

by keeping it wet in a pool, stream or tank or by exposing it to dew. Retting takes from four days in warm water to three weeks in cold water. The water helps soil bacteria penetrate the woody stems and rot them. This loosens the fibers.

Retted flax is dried and seasoned. Then it is broken and scutched usually in the same machine. Rollers break the woody parts. Paddles called scutchers beat

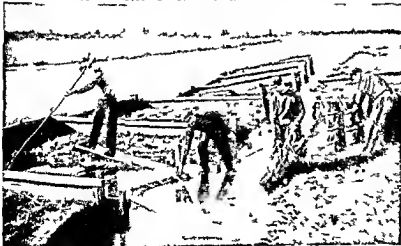
them out of the fiber. Scutched flax goes to a spinning mill. There hankling machines comb it to straighten the fibers and separate the long line fibers from the short tow fibers. These two types of fibers make different kinds of linen (see Linen).

Farmers harvest seed flax with a comb on a mower and thresher. They ship the seeds to a linseed market. Straw from seed flax used to be considered waste. Today the farmer may send it to a delinting plant. There a washing process frees the fibers from the straw. These



The flax plant is a wide stemmed and from two to four feet high. It has narrow leaves and flowers of a delicate sky blue. At the left is a bundle of pulled flax of the straw with the seed pods at the top.

PREPARING FLAX FOR IRELAND'S FAMOUS LINEN



An important step in the preparation of fiber flax is retting. The plant is kept wet in a pool, stream or tank until bacteria in the water penetrate the woody stems and rot them. Some dams keep the bundles of flax from washing away.

fibers are not good for spinning. They go into cigarette paper, upholstery stuffing, insulating material, and fiber rugs. (See also Plant Life, section on "What Men Do with Plants.")

Russia leads the world in growing fiber flax, and Argentina in raising seed flax. Belgium, France, and the Netherlands produce fiber of fine quality. Northern Ireland is noted for the workmanship of its linens. Minnesota and the Dakotas lead the United States in raising seed flax. California and Arizona grow seed flax under irrigation with fall planting. Only Oregon produces fiber flax in commercial amounts.

Cultivated flax is an annual of the species

Linum usitatissimum, family *Linaceae*. The flowers are five-parted, usually blue, but also white or pale pink. **FLEA.** The flea is one of the most troublesome of insects and one of the most dangerous. Rat fleas carry the germs of bubonic plague from rats to man. They also spread the germs of a type of typhus fever. Fleas are tiny insects with bodies thin and flattened from side to side (as a fish is flattened). This makes it easy for them to slip quickly about among the hairs of animals upon which they live, for all fleas are parasitic (see Parasites).

Fleas have no wings, but they are wonderful jumpers by reason of their long froglike hind legs. Their heads have a long sharp sucking beak for puncturing skin and sucking blood.

The eggs of the female flea become scattered in places where animals sleep and in rugs and carpets. The larvae, or young, look like little hairy worms. They have biting mouth parts and live on animal tissues and filth.

Fleas especially infest rats, dogs, cats, hogs, rabbits, pigeons, and poultry. The dog-and-cat types, which will also attack man if given a chance, are found everywhere. To rid a dog or cat of fleas it should be scrubbed in hot soapsuds and dusted with insect powder. The animal's sleeping place should be carefully cleaned. There is also a kind of flea that prefers to live upon human beings. This species does not occur in the United States to any great extent.

Scientific name of dog flea, *Ctenocephalus canis*; of cat flea, *Ctenocephalus felis*; of man flea, *Pulex irritans*. There are about 500 known species of fleas, all of which are parasitic on either mammals or birds. Fleas constitute the order *Siphonaptera*.

FLINT, Mich. Michigan's third largest city, Flint, is known as "the vehicle city" because it is a vast

automobile production center. Before 1900 it made more than 100,000 horse-drawn vehicles a year. Today long, squat, many-windowed automotive factories are

found throughout the city. These assemble cars and trucks and produce such parts and supplies as frames, bodies, engines, spark plugs, speedometers, paints, lacquers, varnishes, and upholstery fabrics. Smaller industries mill flour and shape structural steel. The city is also a wholesale trade center.

Flint lies in southeastern Michigan, 55 miles northwest of Detroit. Both the city and the Flint River, which cuts through it, are named for a river crossing where flint were gathered in old

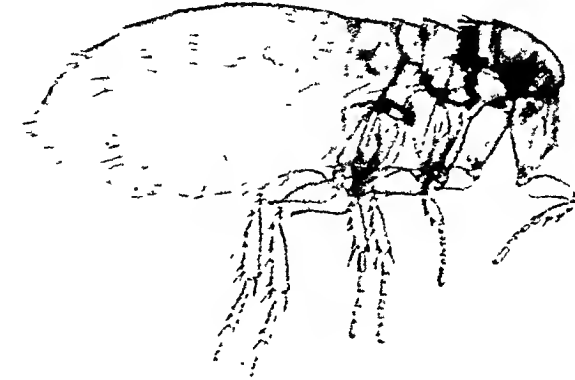
times. The Indian name for the crossing was *Pe-a-go-wing*. It means "flint" or "flint stones."

Flint has a junior college and a state school for the deaf. The Community Music Association sponsors numerous musical activities. The Industrial Mutual Association is an organization of factory workers which promotes educational and recreational opportunities. The General Motors Institute trains more than 10,000 resident and extension students a year. Of interest are an institute of fine arts, an old vehicle collection, and Atwood Stadium.

In 1819 Jacob Smith traded for fur on the site of Flint. In 1830 John Todd brought his family and established a tavern and a ferry on the river. In 1835, two years before Michigan became a state, Flint was made the seat of Genesee County. Flint prospered as a lumbering center, and this led to the manufacture of carts and carriages. Auto manufacture began in 1904. Flint's growth since has been rapid. Among the noted automotive industrialists to come from Flint are William C. Durant, Charles W. Nash, and Walter P. Chrysler. Flint has a council-manager government. Population (1950 census), 163,143.

FLINT. The mineral called flint is a variety of quartz. It consists almost entirely of silica and sometimes contains lime, oxide of iron, water, and carbon. It varies in color from almost black to light brown, red, yellow, and grayish white. Some flint is mottled or spotted, but usually it is gray or smoky brown. When flint is broken by a sharp blow or pressure, the pieces have knife-sharp edges like broken glass. Because of this quality, prehistoric peoples used flint to make axes, arrowheads, knives, and other implements (see Indians). In some regions it is still used to strike sparks for fire lighting.

THE FLEA THAT CARRIES PLAGUE



An agent in spreading bubonic plague is this rat flea, shown greatly enlarged. It is about one-eighth of an inch long. The flea carries bacilli from infected rats and transmits them to any person it bites.

The CAUSES of FLOODS and How Men FIGHT THEM

FLOODS Long before men began to spread over the earth floods ravaged the surface of the land. At the very dawn of history we find men afflicted by them. Stories of flood tragedies like the epic of Noah and the Ark loom large in the traditions of many ancient peoples. Traces of the floods referred to in these stories have been uncovered by archeologists.

Floods in uninhabited lands are merely a part of the natural work of rivers in remolding the surface of the earth (see *Earth Rivers*). But floods where

people live and work bring property damage, suffering and death. With the increase of the world's population through the centuries the effects of floods have become in many ways more disastrous. Along the great river valleys which are the natural pathways of floods lie our most fertile farms, our greatest cities, our easiest lines of transportation. Millions of people and vast concentrations of wealth are now situated in these danger zones.

Once floods were accepted as accidents of the kind which the law calls acts of God, unpredictable and unavoidable. But men have learned more about the part the rivers play in the great hydrologic cycle that carries water vapor from the oceans, lets it fall as rain on the land, and carries it back through the rivers to the ocean again. With this knowledge they have learned to predict many floods, to control the damage done by some of them, and even to prevent a few entirely.

Why Floods Occur

The whole area drained by a river may be likened to a giant sponge. It soaks up a large proportion of the moisture that falls upon it. A part of what is left evaporates. The rest (called the *run-off*) flows into the streams. During the rainy seasons the ground becomes saturated and the moist air allows a little evaporation, so that the run-off is much larger. The same thing happens when winter snows melt. If the ground remains frozen, no moisture can soak into it and virtually all the snow water runs off.

Most rivers can carry the run-off from normal rains or thaws without overflowing, because river beds are shaped by the waters that usually flow through them year after year. The big disastrous floods come when

unusual rains or thaws have occurred over a wide territory. For example, the great Mississippi River flood in the spring of 1927 was due to heavy rains the previous year from Pennsylvania to Kansas, followed by unusual winter and spring rains in the Mississippi Valley itself. The New England floods of 1977 came more suddenly. After the ground was thoroughly saturated by heavy autumn rains, a great storm poured eight inches of rain in two days into the Winoski and Connecticut valleys. Terrible disaster resulted.

A VIOLENT FLOOD IN A NARROW VALLEY



Flood waters are most dangerous when confined in narrow valleys. We can judge their force from this view of the spring of 1936 at Harper's Ferry, W. Va., where the Potomac and Shenandoah rivers meet. The top of a steel bridge at the point was carried into a stream half a mile by the torrent.

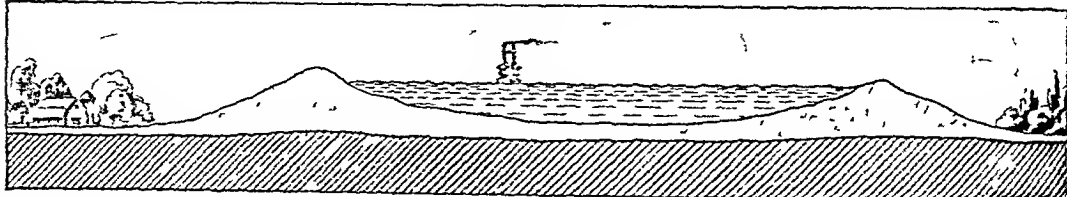
The record floods of 1936 in the north-eastern states came from still another set of circumstances. Heavy snows had piled up during a winter of unbroken cold and the frost was deep in the ground. Early in March mild weather came suddenly with great rains. A prodigious quantity of snow water and rain together swept down into the rivers, many of which were choked with broken ice. Swollen into raging torrents, the rivers swept over cities, destroyed bridges and

drowned scores of people. The floods in the Ohio River basin early in 1937 were due to abnormally warm January weather with long-continued rains. The ground was already saturated by earlier thaws. The Ohio and its tributaries rose slowly but relentlessly until they finally broke all their previous flood records. Muddy waters stood deep in the streets of Cincinnati, Louisville, Paducah, and many other cities. More than 800,000 people were driven from their homes.

These examples suggest how difficult it is to forecast floods. To predict a flood on the lower Mississippi, for example, a weather forecaster in New Orleans must know conditions over the whole area from the Rockies to the Appalachians—how much snow is unmelted, how nearly saturated are the fields and forests, and what areas still have frozen topsoil.

The size and shape of a river channel determine how much water it can hold without overflowing its banks. Young rivers which have cut deep channels for themselves through mountainous country could carry a hundred times the amount of water brought them by the heaviest rains and snows. But older rivers flowing across level plains like the lower

A RIVER FLOWING IN A CHANNEL ON TOP OF A MOUND



Mississippi River, have low banks, and valleys which rise gently at either side, so that points many miles from the channel are only a few feet above the water's surface (see Valleys).

When a great volume of water pours into a young river, the stream stays between the narrow walls of the valley but rises to astonishing heights. Thus Pittsburgh, located in a steep-sided valley, was flooded in 1936 to the tops of two-story and three-story buildings. In an older, flatter valley, floods are not so deep, but cover a greater area. The Mississippi flood of 1927 flooded nearly 30,000 square miles to a depth of only a few feet.

The higher the water rises, the more swiftly it flows and the greater its destructive power. Banks which have resisted years of constant wear from the rivers are eaten away by rushing flood waters in a few hours. Hurling along with express-train speed, a flood confined between valley walls may rip houses from their foundations, wash out bridges, and break open poorly constructed dams. Such floods have been known to pick up heavy locomotives and swirl them along like chips of wood.

Effects of Floods

Eight floods in historic times have taken more than 100,000 lives each, chiefly in China, Japan, India, and the Netherlands. Property loss from the Mississippi flood in the spring of 1927 and the New England floods in the fall of the same year amounted to about half a billion dollars.

The first step after a flood occurs is organization of immediate relief. Boats and rafts are found to rescue people marooned by the rising waters. Tent cities are set up to care for the homeless. Often floods, by interfering with river sewage disposal and contaminating city water supplies, increase the danger of epidemics. Then whole communities are inoculated against diseases. If the flood cuts off all the usual means of transportation, airplanes carry protective serums and other necessities to the isolated



The diagram at the top shows how some rivers build up their own beds and their own banks by silt deposits, until the channels are higher than the surrounding countryside and the danger from floods is increased. When levees, like the one shown in the lower picture, are constructed on each side of a stream to control floods, they sometimes produce a similar result, and if they break, the waters stray over a wide area.

regions. Such work is carried on by private citizens, the Red Cross, and governmental agencies.

The cost of rebuilding ruined homes and factories is sometimes covered by flood insurance, which many business firms and individuals carry (see Insurance). Levees and other defenses against floods which may have been destroyed must be rebuilt, often at enormous cost. To add

one foot to the height of the Mississippi levee system, for example, costs about 35 million dollars. Yet flood control projects cost far less than a single disastrous flood.

One way to avoid flood damage is to locate property where it is in no danger of being flooded. The story of the Tower of Babel tells of an attempt to escape flood damage in this way. But to follow this program would compel men to surrender to the flood-enemy many of their richest regions. From earliest times, therefore, people have settled in valleys and sought means to control floods rather than to avoid them.

Ancient engineers built earthen mounds to shut out the water. Such artificial embankments, called levees, held Chinese rivers in check for many centuries. This method was followed in American colonial days. New Orleans built a levee to protect itself from Mississippi floods as early as 1717.

Modern Levee Building

Since then levee building has progressed rapidly. Because a levee at one point confines the water there and raises the peak of flood waters upstream and downstream, levees once started usually have to be built at all the low points of a river system. Furthermore, a system of levees is only as strong as its weakest spot. Thus uniform height and strength are required.

The states took over levee construction on the Mississippi about 1850, and later the Federal government completed the system. It now includes 1,825 miles of embankment averaging 21 feet in height. Only a government which controls the river from end to end can safely supervise levee building. The damage

done by the great floods which for centuries have ravaged China has been due in part to the fact that the weak central government left the care of levees to local agencies. Smaller levee constructions like the work of the Miami Conservancy District in Ohio, are carried on by state and local cooperation.

To keep the flood water from eating away the levee surfaces, long rooted Bermuda grass is thickly sown on them, or mats woven of willow branches are fastened to them, or the lower slopes of the levees are covered with great asphalt "blankets" or surfaced with concrete slabs. Jettes built out into the stream at angles from the bank tend to slow down the current near the levees.

But levees, if unaided by other flood control devices, have many shortcomings. If they are set far back from the river, valuable land is wasted. If they are set too

close the crowded river may rise too high and either flow over or cut through the embankments. Flood waters are muddy waters; a river left to itself deposits its burden of mud upon the flooded valley lands, enriching the soil and gradually building natural levees along the edges of its flood-plain. When a river is walled in by man-made levees, the mud is carried on to be lost forever in the ocean, or is deposited in the main bed of the river. This latter action gradually reduces the water-carrying capacity of the river and increases the danger of overflow.

Along many Chinese rivers this process of depositing mud on the beds has proceeded so far that the beds are built up higher than the surrounding lands. The river thus flows in channel along the top of a mound. When it breaks its banks, all of its waters are poured out over the countryside. Often the river finds a new channel, permanently inundating a new region and leaving deserted and arid the region that formerly depended upon its waters.

Other Flood Control Devices

To avoid the necessity of building higher and higher levees to hold greater and more disastrous floods, engineers have developed other methods of flood control. One such device is the *spillway* or emergency channel to carry excess water to the sea by a different route. The spillway is shut off from the main channel by a *fuse levee* which permits water to pass only as the rising water approaches the danger line. Two such spillways protect the lower Mississippi; others are planned elsewhere (see Mississippi River).

Straightening and deepening a river channel both increase its capacity and reduce the damage done by the pounding of flood waters on the banks on the outer edges of curves. But in some cases straightening and dredging out the bottom only speed up the flood and cause added damage downstream. Dredging and straightening, therefore, are now done rather to improve navigation than to control floods.

Dams and the reservoirs behind them help to control floods. By emptying a dam before a flood is

expected, storage space is obtained in which the flood waters can be impounded, for gradual release later. Even if the reservoir is nearly full it acts, as do lakes like a safety valve. An amount of water which would add ten feet to the height of a river 100 feet wide would add only one foot to a reservoir or lake 1,000 feet wide. Moreover, evaporation from

the broad surface of a reservoir or lake is far greater than evaporation from the narrow surface of a river. Thus less water flows on to swell floods downstream.

Flood control dams are built to create big storage capacity, and are planned for rapid filling and emptying. Dams to improve navigation, on the other hand, are built to provide a long, narrow reservoir which deepens the channel upstream. Electric power dams are built to provide as great a drop as possible between the reservoir and the channel below. In spite of these different requirements, many purpose dams can be built in some places, and help control floods at the same time that they serve other uses.

Flood Prevention Helps Flood Control

The engineering devices described seek to control floods after the water has entered the river. Land-use methods designed by conservation experts, however, keep water from reaching the rivers in dangerous amounts by holding it on the land.

As we have seen, not all the rain which falls reaches the river. Some evaporates where it falls. Some is absorbed by the vegetation. Some is soaked up by the layer of decaying vegetation, or *humus*, which covers the soil in forests and grasslands. Some sinks, or *percolates*, into the soil and subsoil. Only the water which neither evaporates nor is absorbed runs off to cause floods.

Trees reduce run-off in several ways. Their leaves and branches absorb much water. The accumulation of dead leaves and branches forms an especially thick layer of *humus*, which can absorb several times its

RE-FACING RIVER LEVEES WITH ASPHALT



From the deck of the specially constructed barge at the left, an asphalt mat (see "Flood Control") is being hauled into position on the levee. Such mat (see "Flood Control") protects levee surface from the glancing action of flood waters.

own weight of water. Finally, the roots of trees soak up ground water from saturated earth, and permit it to evaporate from their leaves above, a process called *transpiration*. As a result, little or none of the rain falling on forest land runs off.

Dead blades of grass also accumulate on unplowed land to form water-absorbent humus. Grass reduces run-off in another way. Water cannot soak very quickly or very far into unplanted earth, a cake of water-proof mud is soon formed, the rest of the rain runs off. Grass stalks form funnels through which the water can percolate into the topsoil and later into the subsoil. Alfalfa, clover, and other closely planted, long-rooted plants have the same power to increase percolation, while widely planted crops like corn and fields lying fallow and unplanted hasten run-off.

The great westward movement across America, by cutting down the forests and plowing up the grasslands, increased the proportion of water which runs off to swell floods. To plant grass or forests in areas now planted in crops that increase run-off would of course be impractical, if flood control were the only benefit. But erosion control goes hand in hand with the reduction of run-off. The water carries with it large quantities of the richest topsoil to muddy the rivers and be lost in the ocean. American rivers carry an estimated 10 billion cubic feet of solid matter to the seas each year. Water erosion on hilly farms in some sections is proceeding so rapidly that only rocks and gullies are left after a single generation of planting.

Agricultural experts propose to return the steepest hills along the headwaters of American rivers to forest. By means of terracing, contour plowing, and a wise choice of plants, run-off and erosion are checked on gentler slopes. By damming gullies, run-off is slowed up and silt from above slowly rebuilds the eroded spots. Thus flood prevention and erosion control go hand in hand (see *Conservation*). Preventing soil erosion also aids flood control by slowing down the rate at which silt fills up the reservoirs behind flood-control dams. Steps taken to lessen the effects of drought also aid in flood control. Lakes, swamps, and marshes once drained to make farm lands are being restored to their former condition in order to preserve the level of underground water in time of drought. At the same time this action reduces floods by increasing

evaporation, and by the safety-valve action of wild-lakes or swamps on narrow rivers. Thus the problem of preventing and controlling floods is tied up with drought measures as well as with water power, navigation, soil conservation, and wise land use. (See also *Drought*.)

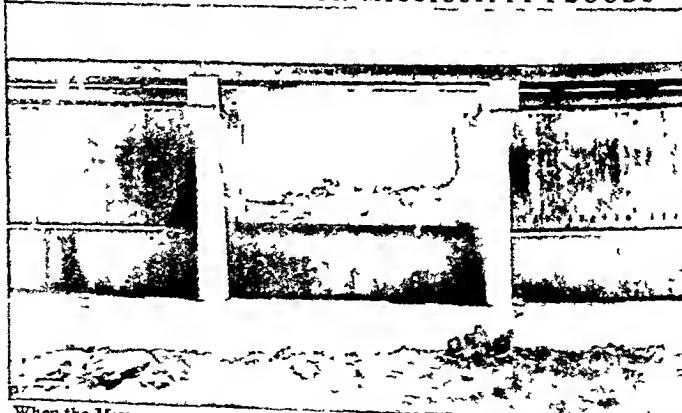
The Egyptians regard floods as a blessing rather than as a disaster. The country is almost rainless. For thousands of years the people have depended on the Nile River to irrigate their crops. But there is little water in the river except when it floods. Fortunately it floods regularly every summer. Instead of building levees to hold back the flood water, the Egyptians build barriers across the valley to raise the height of the flood so that it will spread over a greater area. Formerly the farmers could raise only one crop a year, planted when the water drained away. Now great dams on the upper river store the water and let it out through the year, so that two or three crops may be raised. (See also *Egypt*; *Nile River*.)

Ocean Floods

Often more disastrous than river floods are the great catastrophes which follow invasion of the land by the ocean. Volcanic eruptions may cause huge waves which swamp seacoasts far and near. The eruption of Krakatoa in 1883 dumped much rock and lava into the ocean, and formed waves which inundated whole districts in Java and Sumatra and were felt half-way round the world in South America. The

Lisbon earthquake of 1755 was followed by a similar flood. Hurricanes and tornadoes, especially if they strike the coast at high tide, create great waves which may engulf seaport cities. Such a hurricane-created flood swamped Galveston, Tex., in 1900 with a loss of 5,000 lives; another struck in 1915. In 1953 a terrific hurricane roared

A SPILLWAY GATE FOR MISSISSIPPI FLOODS



When the Mississippi rises enough to endanger New Orleans, about 35 miles downstream, these gates or "needles" are raised. Through them flood waters surge harmlessly down the Bonnet Carré Floodway into Lake Pontchartrain and the Gulf.

down the North Sea and threw its force behind a high spring tide. Flood waters swept over eastern England, up the estuaries of the Humber, Ouse and Thames; but the low Netherlands was hardest hit. There great sea walls—which the Dutch call dikes—had been erected at tremendous cost to hold the sea back. The flood tore great holes in the dikes, swept up the Maas and Waal rivers, and covered the low islands of Zeeland in the southwest. Thousands were made homeless and 1,760 died. In England, 546 people lost their lives. (See *Galveston*; *Netherlands*.)

FLORENCE, the Cradle of the RENAISSANCE

FLORENCE, ITALY From Michelangelo Terrace in Florence, one can look down over the city. The proud towers, domes, and spires rise on both sides of the blue Arno River, and the sun glints on the masses of marble and gleaming bronze that fill the spacious squares. To the northeast rise foothills, spurs of the Apennine Mountains, mantled green with grape vines, olive groves, orchards, cool pines and cypress, and ribboned by white roads hedged with roses. From the beauty of the city and its neighboring hills comes the name Florence, *Firenze* in Italian, meaning 'the flowering.'

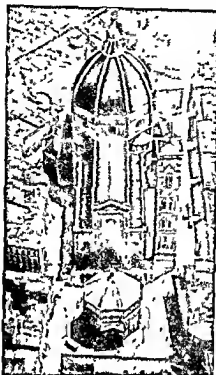
Yet few great cities have arisen from such humble beginnings. Centuries ago Florence was only a squat little market place for the old Etruscan town of Fiesole (Latin *Faestulae*), which crowned a hill five miles to the northeast. From their hilltop town the people of Fiesole came down to buy produce from farmers who gathered on the level clearing along the Arno. About 187 B.C. the Romans built one of their great roads through the little market place, and it became a settlement. Some 150 years later, Augustus established a military garrison here.

As the Romans improved their roads and spread a network through central and northern Italy, Florence prospered. It was the natural trade center for goods brought down through the Apennines from upper Italy. The city's climate gave it another advantage, for the sharp changes in weather stimulated the energies of the people. Both the winter and summer climate were more extreme than in Rome, 150 miles to the south.

The City Gains Independence

The thriving city tempted invaders. In 401 a horde of Ostrogoths besieged Florence, and in 542 the Goths attacked it in vain. Later in the 6th century the great tide of the Lombard conquest swept over Florence, and the city became the capital of a dukedom. After the Lombards were expelled by Charlemagne, he ordered in 799 new fortifications for Florence. When Charlemagne's death in 814 ended the Holy Roman Empire, it became virtually a city-state.

In its new freedom, the city grew rapidly. From the Celts and other northern European invaders the Florentines had inherited vigor and enterprise. They



This air view of Florence shows three of Europe's most notable buildings. The long, domed cathedral in the center and the octagonal baptistery in front of it are medieval. Giotto's bell tower rising at the right, is of the Renaissance period. All were spared by shell fire in the second World War.

became brisk, adventurous merchants and bankers, artisans and tradesmen, statesmen and soldiers. By the 12th century their guilds were among the most powerful in Europe and Florentine silk and wool textiles were sold in all parts of the continent. Florentine bankers financed hundreds of enterprises abroad. In 1252 the city coined its first gold pieces. They were called florins and became standard gold coins for Europe. Through the 13th, 14th and 15th centuries, rich ambitious Florence warred mightily with Pisa, Siena, and other rival Tuscan cities (from the old name 'Etruscan'). In 1421 Florence bought the port of Livorno (Leghorn) from the Genoese to obtain a command of the rich sea trade.

The Birthplace of Renaissance Art

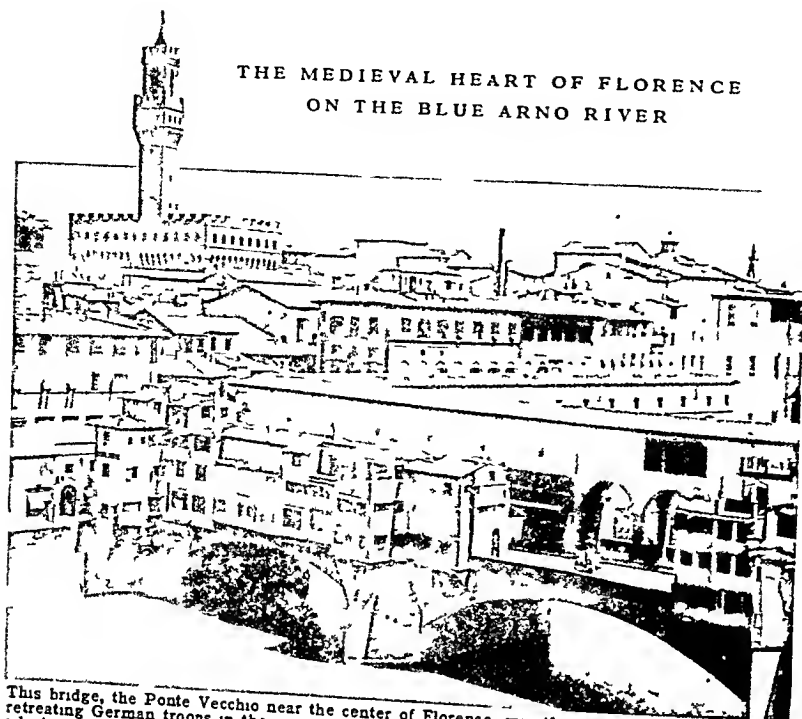
The city became a center of art and culture. Gifted architects, painters, sculptors, and metal workers joined to embellish Florence with magnificent buildings. Work on the St. John baptistery was probably begun as early as the 7th century and continued

through the 15th, when it received the most famous doors in the world—gilt-bronze portals by Ghiberti (see Ghiberti). Near the baptistery Florentines built their *duomo* or cathedral. St. Mary of the Flowers probably begun in 1299. At its side rose a campanile. Giotto's bell tower (see Giotto). In 1298 work began on the battlemented castle that came to be called *Palazzo Vecchio*—Old Palace.

The beauty, rest and daring of Florence combined to make it the cradle of the Renaissance, the 're-birth' of classic art and learning that led Europe out of the Middle Ages (see Renaissance). It was in Florence that Dante wrote poetry so exquisite that it made the Florentine dialect the official language of Italy. From Florence too came Petrarch's stimulating sonnets and Machiavelli's brilliant cynical political writings. There Michelangelo worked by day on the city's fortifications and, at night, created his immortal paintings and statues. Leonardo da Vinci learned to paint in Florence, where Donatello and Raphael and Luca della Robbia were also students.

As these immortal works gathered through the centuries, Florence became one of the great treasure houses of the world. Many of its finest art pieces

THE MEDIEVAL HEART OF FLORENCE ON THE BLUE ARNO RIVER



This bridge, the Ponte Vecchio near the center of Florence, was the only span spared by the retreating German troops in the second World War. They destroyed the medieval buildings which once clustered at the left. The Uffizi Gallery, rising above the bridge at the right, was heavily shaken but its art treasures were saved. The 13th-century Palazzo Vecchio with its tall tower, rising in the background, was only slightly damaged.

were stored in the Uffizi Palace on the east bank of the Arno. To connect it with the rich Pitti Palace across the Arno, Florentines in 1345 built a bridge, which came to be called *Ponte Vecchio*, "Old Bridge." Shops of craft workers and artists, especially goldsmiths, lined the bridge.

A Battleground in Italian History

Although early Florence had enjoyed considerable independence, it had belonged nominally to the Countess Mathilda, a representative of the German emperor. At Mathilda's death in 1115 she bequeathed Florence to the papacy. About a century later the papal power was supported by a political group called the Guelfs, and the German emperor was supported by another party called the Ghibellines (see Guelfs and Ghibellines). In 1215 the rival factions tried to seize control of Florence and plunged the city into strife, which lasted over 50 years.

The Guelfs, aided by the pope, largely prevailed until 1260, when their army was virtually destroyed at the town of Siena. The Ghibellines took control of Florence and held it until 1266, when Charles of Anjou, champion of the pope, marched over from France and smashed the forces of the German emperor at the battle of Benevento. Now the Guelf exiles returned to Florence. But to reduce the power of the merchant-nobles, Ordinances of Justice were passed in 1293 to exclude from office all persons who were members of Florentine guilds. Thus many of the most powerful Florentines were barred from public positions

For about 150 years Florence remained a republic. All power, however, was soon concentrated again in the hands of the wealthy—some 5,000 persons out of the city's population of 100,000. In reviewing this troubled period, the historian Niccolò Machiavelli wrote: "At first the nobles were divided against each other, then the citizens against the nobles... and it often happened that when one of these parties got the upper hand, it split in two. And from these divisions there resulted so many deaths, so many banishments, so many destructions of families, as never before in any other city of which we have record."

Under Medici Rule

Out of this confusion, the city gradually fell into the power of the Medici family (see Medici). Under the guidance of the shrewd, conniving but generous

Cosimo de' Medici (1389–1464), Florence became the refuge of exiled Greek scholars. But it was Cosimo's grandson, Lorenzo the Magnificent (1449–1492), who led Florence to its greatest triumphs of culture, when every art and science flourished.

After the death of Lorenzo, abuses and loose living tainted the luxurious life of Florence. In an effort to reform it and to restore the city republic, the Dominican friar Girolamo Savonarola stirred up the people and expelled the Medici. He ruled Florence until 1498, when he was executed (see Savonarola).

After the Medici were restored in 1530, Florence ceased to have a separate history. Its fortunes merged with those of the Grand Duchy of Tuscany, which passed to the Austrian Hapsburgs in 1743. In 1859 the whole of Tuscany was annexed to the newly formed kingdom of Italy. Florence was capital of the kingdom from 1865 until 1870, when Rome became the capital.

In the second World War, Florence again became a battleground. Soon after Italy entered the war on the side of Germany in 1940, German troops occupied the city. The Allies bombed it, but spared notable buildings. When the Allies advanced in 1944, the Germans declared Florence an open city. Despite this, they remained to fight. They destroyed all bridges but the Ponte Vecchio, and demolished the medieval dwellings in the heart of the city. Less seriously damaged structures were restored by the Allied Military Government. Population (1951 census, preliminary), 375,392.

The SOUTHERN FINGER of the UNITED STATES



Along Florida's Semitropical Coasts Friendly Roads Wind through Palms Rustling in Warm Sea Breezes

FLORIDA Like a giant forefinger Florida extends south from the great mass of the United States partly enclosing the Gulf of Mexico. With Cuba and the northward jutting peninsula of Yucatán it forms a barrier which almost closes the eastern approaches to this great body of water. Florida ends in a chain of some 10,000 tiny islets and sandbanks called the Florida Keys (*see* Key West). The southernmost mainland point of the United States is Cape Sable.

Florida lies in approximately the same latitudes as Egypt. In many ways however it is comparable rather to Italy. Both are peninsulas with mild winter climates tempered by the seas which nearly surround them. Both are world playgrounds. Sun warmed beaches and luxurious hotels fringe their coasts. Beautiful inland lakes add to the enjoyment of pleasure seekers. But instead of purple mountains mantled with olive and chestnut groves Florida has vast citrus orchards, dark mysterious mangrove and cypress swamps and broad flat prairies covered with grass and patches of palmetto. Italy boasts of its ancient cities and historic ruins. Most of Florida's cities are young, owing their development to the extension of the railroads in the 1880's and many have sprung up

since 1900 from swamps and coral rock and sand bar. Yet Florida is not a young state.

More than 400 years ago on April 2, 1513, Ponce de León said to be seeking the legendary Fountain of Youth sighted the Florida coast. This was shortly after Easter Sunday (Spanish *Pascua Florida*). The next day he landed near the present site of St. Augustine. He claimed the territory for Spain and named it either in honor of Easter or for the abundant flowers (Spanish *florida* means "flowery") which he found growing everywhere. (*See* Ponce de León).

Ill-fated Venture of Narváez

Late in 1528 the Holy Roman Emperor Charles V (as Charles I of Spain) granted a tract of this new land to Pánfilo de Narváez, another Spanish explorer. After a stormy voyage from Spain he reached Tampa Bay with about 400 men in April 1528. For months the explorers tramped through forests and treacherous swamps. They came out near what is now St. Marks and waited for supply ships which failed to find them. In the hope of reaching their countrymen in Mexico they constructed boats and sailed away. Only a few ever saw their destination for a gulf storm destroyed Narváez and most of his men.

HERE FLORIDA'S LAWS ARE MADE



Florida's Capitol stands on a landscaped knoll in Tallahassee. The main building was completed in 1845, the year Florida was admitted to the Union. The east and west wings were finished in 1923, the north wing in 1937, and the south wing in 1948.

Shortly thereafter, Charles V appointed Hernando de Soto governor of the new province, and in 1539 this daring explorer sailed into Tampa Bay with 700 men. From here he set out on a historic expedition. He dreamed of finding the fabled riches of "El Dorado" and of eclipsing the achievements of Cortez in Mexico and Pizarro in Peru. In the course of his search he marched northward through the Florida wilderness into Georgia and Alabama to the Mississippi River (see De Soto).

Spaniards and Huguenots Wage Wars

Spain remained undisturbed in its search for gold in Florida until the French Huguenots sought a haven there from religious persecution. Led by Jean Ribaut, they landed at the mouth of the St. Johns River in 1562 and unfurled the French flag. Another group of Huguenots followed and built Fort Caroline on the banks of the St. Johns. The Spanish resented their presence. When Pedro Menéndez de Avilés arrived in 1565 with 19 ships and 1,500 men, he captured Fort Caroline (renaming it San Mateo) and killed nearly all the colonists. He treated them, as he said, "not as Frenchmen, but as heretics." Two weeks earlier Menéndez had founded St. Augustine, the first permanent settlement in the territory. He also explored part of the eastern coast and built forts at Avista, Gualo, and St. Helena.

To avenge the death of Ribaut and the French, Dominique de Gourgues captured Fort San Mateo in 1568 and hanged the Spanish colonists. He left this inscription

on a pine slab: "I do this not as unto Spaniards but as to traitors, robbers, and murderers."

Sir Francis Drake and his band of adventurers plundered and burned St. Augustine in 1586. Eighty years later, John Davis and his bold English buccaneers again destroyed this settlement (see St. Augustine).

St. Augustine and the few forts on the eastern coast represented all of Spain's efforts to colonize Florida until 1698, when Pensacola was founded. For the next 150 years the Spaniards quarreled with the English colonists in the Carolinas and Georgia. By a treaty in 1763 Spain gave up Florida to England and received Havana. The British divided Florida into two provinces, East and West Florida. The colony prospered, and in 20 years the white population in-

creased to about 25,000. During the American Revolution, Spain declared war on England and sent an expedition against Florida. In 1783 England was forced to return Florida to Spain.

United States Gets Territory from Spain

For over a quarter century the United States and Spain disputed the boundary in West Florida. Then in the Adams-Onís Treaty (1819-21) Spain ceded to the United States both East and West Florida. In return the United States gave up its claims to Texas and promised to pay Spain 5 million dollars.

In 1822 Florida was organized as a territory. The Seminole Indians were forced to accept land in the West at the conclusion of seven years of warfare during 1835-42. Florida entered the Union as a state

THE UNIVERSITY OF FLORIDA'S MODERN CAMPUS



Gainesville, in the northeastern part of the state, is the site of the University of Florida. This state institution of higher learning was established in 1853. North Hall, a men's dormitory with modern architectural lines, is shown here.

FLORIDA'S ROMANTIC STORY IN PAST AND PRESENT TIMES



This bird's-eye view of Florida presents interesting facts about the region and history of the state. Shortly after Easter day in 1513 Ponce de Leon landed near the present site of St. Augustine and then continued his voyage in search of the Fountain of Youth. In 1519 came Pineda's voyage. Narváez landed at Tampa Bay in 1528 and traveled overland to Apalachee Bay.

In 1539 the land was partially explored by De Soto. In 1562 R.baut with a band of French Huguenots landed on the east coast and claimed the country on behalf of France. Three years later the Spaniard Menéndez de Avilés captured the French Fort Caroline and put almost the entire garrison to death. He founded St. Augustine, the oldest city in the United States.

in 1845 but seceded as a Confederate state in 1861 (See also chronology in Florida Fact Summary.)

An Agricultural Paradise

Florida's wealth was scarcely touched until 1875. Then it was found that oranges could be grown profitably in the semitropical belt across the middle of the state. Next a market developed for grapefruit raised in the southern part of the state. Today citrus fruits and truck crops provide a large part of Florida's farm income. The state usually produces about one half of the country's grapefruit and oranges. Most of this enormous crop is shipped to market in its fresh state. An increasing amount is being canned before shipment, however. A recent and fast-growing industry is the quick freezing of juices.

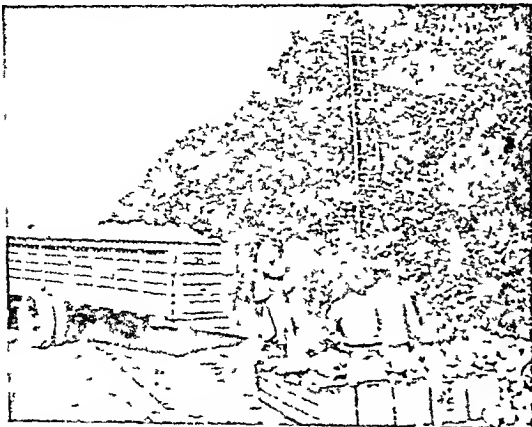
Next it was found that pineapples could be raised in abundance along the east coast from a few miles north of Palm Beach to the Keys at the southern tip of the peninsula. Now Florida is a paradise of strange exotic fruits, many of which find their way to Northern markets. One of the most popular is the dark green avocado, or alligator pear, native to Mexico and Central and South America. Long before civilization

crept into the Florida wilderness the tamarind, probably an immigrant from the West Indies, grew there. Tall mango trees shade the streets and yield a luscious melon-shaped fruit. Fruits that are not familiar to growers in Northern states include the tart, bittersweet pomegranate, the brownish fruit of the sapodilla (whose sap yields latex) and the fig. Other favorites in Florida orchards are the papaya, tangerine, guava, kumquat, and the pretty Japanese loquat. Better known than these among Florida fruits are persimmons, peaches, bananas, pears, plums, and grapes.

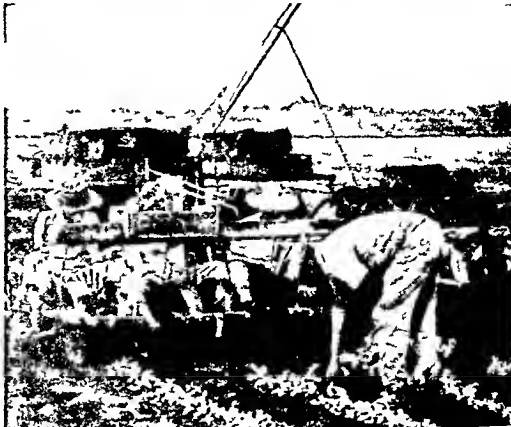
Corn, tobacco, and potatoes are among the most valuable of the state's other agricultural products. Sweet potatoes, sugar cane, peanuts, cotton, and berries add to the state's wealth. Between November 15 and July 1, truck farmers ship thousands of carloads of fresh vegetables to Northern centers where they compete with the greenhouse products of the colder sections. Also important as sources of wealth are livestock and their products, including cattle and calves, dairy products, hogs, chickens, eggs, and turkeys.

Ramie or China grass, a fiber of the nettle family, is grown for cloth, paper, and other uses.

LEADING AND UNUSUAL PRODUCTS FROM FLORIDA'S FARMS



This golden harvest of grapefruit is part of the huge annual crop that makes Florida a leader in the production of citrus fruit.



A celery planter makes back-breaking work easier and faster. Florida supplies the nation with great amounts of truck crops.



Strange tropical and semitropical fruits thrive in southern Florida's mild climate. Above are a pineapple and papayas.



Hump-shouldered Brahman cattle, imported from India, improve Florida's breeds. Cattle raising is of growing importance.

Large herds of beef cattle graze on the open range of the rich Kissimmee prairie, north of Lake Okeechobee, and on reclaimed areas in the Everglades.

Forests of cypress and long-leaf and slash pine are an important source of wealth. They supply the raw materials for some of the state's largest industries. These include sawmills and planing mills; pulp, paper, and paperboard mills; and plants distilling turpentine, rosin, and similar soft-wood products. Florida is a leading state in the production of tung oil. This powerful drying oil is obtained from the nuts of the tung tree. Also important are the canning of fruits and vegetables, the manufacture of fertilizers, shipbuilding, and ship repairing.

Florida mines three fourths of the nation's phosphate. Uranium is removed from its phosphate fertilizers. It shares with Georgia the country's largest deposits of fuller's earth. Other important minerals are stone, cement, and sand and gravel. Ilmenite and rutile produce titanium, used in paint and alloys.

More than 500 species of fish inhabit the coastal waters. Among those of commercial value are shrimp, oysters, mullet, red snappers, mackerel, menhaden,

groupers, sea trout, catfish, and bullheads. New shrimp grounds are being developed off Key West. Tarpon and other large game fish attract sportsmen.

Greek divers began the sponge-fishing industry at Tarpon Springs on Florida's west coast in 1905. This resort and residential city is now one of the important sponge-fishing centers of the world.

The demand for alligator-skin handbags, shoebelts, and similar articles nearly exhausted the supply of alligators in native haunts. Large farms for raising them have now been established.

A Semitropical Climate

Florida's greatest attraction for residents of other states is its delightful winter climate. The Gulf Stream, flowing from the Gulf of Mexico between Cuba and Key West and fringing the eastern coast, moderates the climate for most of the peninsula. On the western coast, the Gulf of Mexico has a similar influence. The mean annual temperature ranges from about 70°F. in the north to about 75° in the south. Florida lies in the same latitudes as the northern part of the torrid Sahara. In the summer, however, the temperatures average little above 80°F. through-

Continued on page 151

Florida Fact Summary



FLORIDA (Fla) Named from *Pascua florida* ('flowery feast'), Spanish name for Easter Sunday, when Florida was discovered or from the abundance of flowers growing there. Nicknames 'Everglade State,' from the Everglades of southern Florida. Also, the 'Peninsula State.'

Soul Sun rises over highlands, steamboat rides water at night, a coconut palm stands in the middle distance, in the foreground an Indian woman scatters flowers on the ground. State motto at bottom.

Motto In God We Trust

Flag For description and illustration, see **Flags**

Flower Orange blossom **Bird** Mockingbird **Tree** Sabal palmetto **palm Song**: 'Swanee River' (Old Folks at Home'), by Stephen Foster

THE GOVERNMENT

Capital Tallahassee (since 1824 when it became territorial capital)

Representation in Congress Senate, 2, House of Representatives, 8. Electoral votes, 10

State Legislature Senators, 38, term, 4 years Representatives, 95, term, 2 years. Convenes the first Tuesday after the first Monday in April in the odd-numbered years, session is limited to 60 days.

Constitution Adopted 1837. Proposed amendment must be (a) passed by a three-fifths vote of both legislative houses and (b) ratified by a majority voting on amendment at a popular election.

Governor Term, 4 years. May not succeed himself.

Other Executive Officers Attorney general, secretary of state, treasurer, comptroller, commissioner of agriculture, supt. of public instruction. Elected terms 4 years.

Judiciary Supreme court—6 justices, elected at large, term, 6 yrs. Circuit courts—15 circuits. 2 to 7 elected judges in each circuit term, 6 yrs. County judges court—1 in each county, judges elected term, 4 yrs.

County 67 counties, each governed by a board of 5 elected commissioners, term, 4 years. Other county officials elected for similar terms.

Municipal 58 cities have city manager-council plan of government, others have commission, mayor-council, or mayor-commission plans.

Voting Qualifications Age, 21, residence in state, 1 year, in county, 6 months.



THE PEOPLE AND THEIR LAND

Population (1950 census) 2,771,305 (rank among 48 states—20th), urban, 65.5% rural 34.5%. Density 51.1 persons per square mile (rank—26th state).

Extent Area, 58,560 square miles, including 4,298 square miles of water surface (21st state in size).

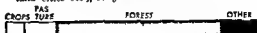
Elevation Highest, in Walton County in northwestern Florida 345 feet, lowest, sea level.

Temperature (°F) Average—annual, 71° winter, 60°, spring, 70° summer, 81° fall, 72°. Lowest recorded, -2° (Tallahassee, Feb. 13, 1839) highest recorded, 109° (Monticello, June 29, 1931).

Precipitation Average (inches)—annual, 53 winter, 9, spring, 10 summer, 21 fall 13. Varies from about 64 in southeast to about 46 on west coast.

Natural Features Five major sections—Atlantic coastal plain from St. Marys River to Florida Keys central ridge and lake region, Gulf coastal plain north and south of Tampa rolling hills in the west Florida panhandle, Everglades, cypress and mangrove swamps south of Lake Okechobee. Principal rivers Apalachicola, Kissimmee, St. Johns, Suwannee.

Land Use Cropland, 7%, nonforested pasture, 12%, forest 67%, other (roads, parks, game refuges, waste-land cities etc.), 14%.



Natural Resources. *Agricultural*—semitropical climate, soils chiefly sands and sandy loams ample rainfall, these resources support huge citrus-fruit industry and profitable truck-crop farms. *Industrial*—many forests, valuable fisheries phosphate rock, stone cement, and sand and gravel. *Commercial*—attractive climate for winter vacations good harbors.

OCCUPATIONS AND PRODUCTS

What the People Do to Earn a Living



Major Industries and Occupations 1950

Fields of Employment	Number Employed	Percentage of Total Employed
Wholesale and retail trade	240,311	23.9
Agriculture forestry and fishery	134,074	13.3
Personal services (hotel domestic laundering etc.)	122,121	12.1
Manufacturing	108,325	10.7
Construction	90,528	9.0
Professional services (medical legal educational etc.)	81,110	8.0
Transportation communication and other public utilities	78,707	7.8
Government	57,959	5.1
Finance insurance and real estate	38,157	3.8
Business and repair services	27,586	2.7
Amusement, recreation, and related services	15,026	1.5
Mining	8,302	0.5
Workers not accounted for	16,409	1.6
Total employed	1,009,615	100.0

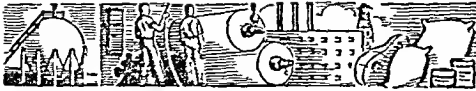


TRANSPORTATION AND COMMUNICATION

Transportation Railroads, 4,800 miles. First railroad east from St. Joseph (now a ghost town) to Lake Wales near Apalachicola, 1836. Rural roads, 41,500 miles. Airports 176.

Communication Periodicals, 49 Newspapers, 194. First newspaper, *East Florida Gazette*, St. Augustine, 1783. Radio stations (AM and FM), 89, first station, WQAM, Miami, licensed February, 1921. Television stations, 5, first station WTVJ, Miami, began operation March 21, 1949. Telephones, 909,900. Post offices, 653.

Florida Fact Summary



What the People Produce

A. Manufactured Goods (Rank among states—30th) Value added by manufacture* (1952), \$633,684,000

Leading Industries in 1947 (with Principal Products)	Value Added by Manufacture	Rank among States
FOOD AND KINDRED PRODUCTS ... Canned fruits, vegetables, and soups; bakery products; manu- factured ice; bottled soft drinks	\$92,324,000	25
PAPER AND ALLIED PRODUCTS ... Pulp, paper and paperboard mills	55,777,000	16
LUMBER AND PRODUCTS ... Sawmills and planing mills; wood- en boxes; wood preserving	47,184,000	19
PRINTING AND PUBLISHING ... Newspapers; commercial printing	34,706,000	19
CHEMICALS AND ALLIED PRODUCTS Fertilizers; gum; wood chemicals	28,774,000	29

*For explanation of value added by manufacture, see Census



B. Farm Products (Rank among states—27th) Total cash income (1951), \$498,848,000

Products	Amount Produced (10-Year Average)	Rank within State*	Rank among States†
Oranges.....	46,070,000 boxes	1	2
Truck crops.....	723,000 tons	2	4
Grapefruit.....	27,280,000 boxes	3	1
Milk.....	208,000,000 qts.	4	41
Hogs.....	112,827,000 lbs.	5	28
Cattle.....	128,789,000 lbs.	6	34
Tobacco.....	19,296,000 lbs.	7	12
Corn.....	7,831,000 bu.	8	30
Chickens.....	29,940,000 lbs	9	36

*Rank in dollar value †Rank in units produced



C. Fish (Rank among states—6th) (Marine waters and coastal rivers, 1950), catch, 118,478,000 lbs.; value, \$15,704,000

D. Minerals (Fuels, Metals, and Stone) Annual value (1951), \$78,548,000 Rank among states—28th

Minerals (1951)	Amount Produced	Value
Phosphate rock.....	8,497,000 tons	\$50,263,000
Stone.....	8,033,000 tons	9,420,000
Cement*.....		
Sand and gravel.....	4,419,000 tons	
Clays.....	133,000 tons	2,289,000

*Cement ranks 3d in value; exact figures not available.

E. Lumber (Rank among states—16th) 513,000,000 board feet (5-year average)

F. Trade

Trade (1948)	Sales	Rank among States
Wholesale.....	\$2,001,664,000	24
Retail.....	2,340,395,000	15
Service.....	330,334,000	11

EDUCATION

Public Schools: Elementary, 1,263; sec-
ondary, 471. Compulsory school
age, 7 through 16. State Board of
Education composed of governor,
secretary of state, attorney general,
treasurer, and state supt. of public
instruction; elected, 4-yr. terms.
County school boards of 5 members
elected, 4-yr. terms. County supts. elected, 4-yr. terms.
Private and Parochial Schools: 218.



Colleges and Universities (accredited): White, 8; Ne-
gro, 3. Junior colleges: White, 5; Negro, 1. State-sup-
ported schools include Univ. of Fla., Gainesville; Fla.
State Univ., Tallahassee; Palm Beach Jr. Col., West
Palm Beach; St. Petersburg Jr. Col., St. Petersburg;
Chipola Jr. Col., Marianna; Pensacola Jr. Col., Pensac-
ola; Fla. A. and M. Univ. for Negroes, Tallahassee.
State School for the Handicapped: State School for Deaf
and Blind, St. Augustine.

Libraries: City and town public libraries, 51. Dept. of
Education aids in developing school library service;
work headed by consultant on school libraries. State
Library Board aids in developing public library ser-
vice; work headed by director of library extension.
Outstanding Museums: Florida State Museum, Gaines-
ville; Children's Museum, Jacksonville; Lightner's
Hobby Museum, St. Augustine; Ringling Art Museum,
Sarasota; Beal Maltbie Shell Museum, Winter Park.

CORRECTIONAL AND PENAL INSTITUTIONS

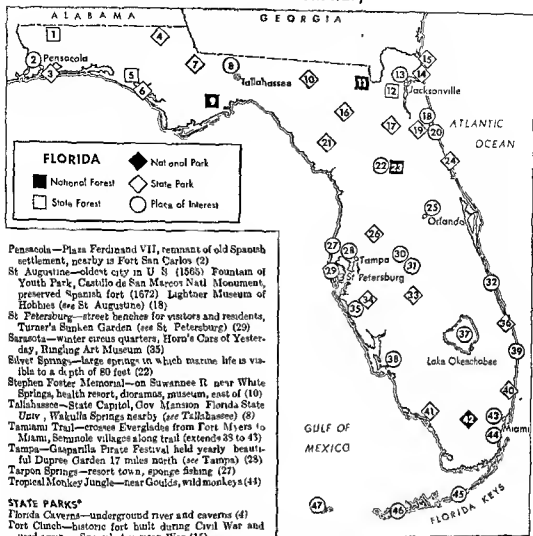
Industrial School for Boys, Marianna; Industrial
School for Girls, Ocala; State Prison, Raiford; State
Prison No. 2, Belle Glade. Apalachee Correctional In-
stitution, Chattahoochee.

PLACES OF INTEREST*

Bok Singing Tower in Mountain Lake Sanctuary—bird
sanctuary; carillon recitals, December–April (31).
Cypress Gardens—near Winter Haven; azaleas, garden-
ias; water-skiing shows; boat tours (30).
De Soto National Memorial—near Bradenton; site of ex-
plorer's landing in Florida in 1539; northwest of (35).
Fairchild Tropical Gardens—Coral Gables; tropical plant
life from areas throughout the world (43).
Fort Caroline National Memorial—Jacksonville; fort
built by René Laudonnière and Huguenots, 1564 (13).
Fort Jefferson National Monument—in Dry Tortugas;
masonry fort (1846); federal prison in Civil War (47).
Fort Matanzas National Monument—17 mi. s. St. Augus-
tine; built by Spanish to protect city (1737) (20).
Hialeah Park Race Track—near Miami; famous track,
flower beds, artificial lake, and pink flamingos (43).
Jacksonville—near ocean beaches (see Jacksonville) (13).
James Melton Autorama—Hypoluxo; auto museum (39).
Key West—winter health resort (see Key West) (46).
Killearn Gardens—Tallahassee; azaleas, gardenias (8).
Lake Okechobee—immense body of shallow water (37).
Lake Wales—pageants; Passion Play, Florida Aflame (31).
McKee Jungle Gardens—many tropical plants (32).
Marine Studios—aquarium of tropical marine life (20).
Mead Botanical Garden—between Orlando and Winter
Park; height of orchid season, January–May (25).
Miami—famous winter resort; (see Miami) (43).
Overseas Highway—from mainland to Key West; longest
“bridge” in the world; extends 156 miles (45).
Palm Beach—fashionable winter resort (39).

*Numbers in parentheses are keyed to map.

Florida Fact Summary



Pensacola—Plaza Ferdinand VII, remnant of old Spanish settlement, nearby is Fort San Carlos (2)

St. Augustine—oldest city in U.S. (1565) Fountain of Youth Park, Castillo de San Marcos Natl. Monument, preserved Spanish fort (1672) Lightner Museum of Hobbies (see St. Augustine) (18)

St. Petersburg—street benches for visitors and residents, Turner's Sunken Garden (see St. Petersburg) (29)

Sarasota—winter circus quarters, Horne's Cars of Yesterday, Ringling Art Museum (35)

Silver Springs—large springs in which marine life is visible to a depth of 80 feet (22)

Stephen Foster Memorial—on Suwannee R. near White Springs, health resort, dioramas, museum, east of (10)

Tallahassee—State Capitol, Gov. Mansion Florida State Univ., Wakulla Springs nearby (see Tallahassee) (8)

Tamiami Trail—crosses Everglades from Fort Myers to Miami, Seminole villages along trail (extends 35 to 43)

Tampa—Gasparilla Pirate Festival held yearly beautiful Dupree Garden 17 miles north (see Tampa) (23)

Tarpon Springs—resort town, sponge fishing (27)

Tropical Monkey Jungle—near Goulds, wild monkeys (44)

STATE PARKS*

Florida Caverns—underground river and caverns (4)

Fort Clinch—historic fort built during Civil War and used again in Spanish American War (15)

Gold Head Branch—built around ravine 65 feet deep, "sink hole" lakes fed by underground seepage (17)

Highlands Hammock—diverways and trails through dense jungle and swamps, gigantic oaks, wild deer (33)

Hillsborough River—water sports, nature trails (26)

Killearn Gardens—exotic gardens, east of (8)

Myakka River—wildlife sanctuary (34)

O'Leno—forests, Santa Fe R. disappears into a sink (16)

Torrey—plantation house, Torrey trees preserved (7)

Anastasia (19), Collier Seminole (41), Hugh Taylor Birch (40), John F. Rollins Bird and Plant Sanctuary (14), Jonathan Dickinson (36), Little Talbot Island (14), Manatee Springs (21), Pellicer Creek (19), Rabbit Refuge (24), St. Andrews (6), Santa Rosa (3), Suwannee River (10), Tomoka (24)

STATE FORESTS*

Blackwater River—182,000 acres (1), Cary—3,400 acres (12), Pine Log—7,000 acres (5)

* Numbers in parentheses are keyed to map

NATIONAL PARK*

Everglades National Park—1,259,361 acres, cypress and mangrove swamps, rare plants and animals (42)

NATIONAL FORESTS*

Apalachicola—633,217 acres, hdqrs., Tallahassee (9)

Ocala—441,945 acres, hdqrs., Tallahassee (23)

Oscola—161,814 acres, hdqrs., Tallahassee (11)

LARGEST CITIES (1950 census)

Miami (249,276) winter resort, citrus-fruit market

Jacksonville (204,517) inland port, industrial center

Tampa (124,681) gulf port, manufactures cigars

St. Petersburg (96,733) winter resort, fishing

Orlando (52,367) citrus-fruit growing and canning

Miami Beach (46,282) winter resort, water sports

Pensacola (43,479) naval air station, paper mills

West Palm Beach (43,162), Fort Lauderdale (36,328),

Lakeland (30,851), Daytona Beach (30,187), Tallahassee (27,237), state capital, Gainesville (26,861)

Florida Fact Summary

THE PEOPLE BUILD THEIR STATE



- 1513—Ponce de Leon lands on coast near present St. Augustine; names the area Florida, claims it for Spain.
- 1521—Indians prevent Ponce de Leon from establishing a colony near Charlotte Harbor. He returns to Cuba.
- 1528—Pánfilo de Narváez attempts to claim land near Tampa Bay given him by Spanish king. Tramps Florida swamps for months. Gulf storm destroys most of his party.
- 1539—Hernando de Soto appointed governor of new province by Charles V of Spain; begins four-year search for cities of gold.
- 1562—French Huguenot colonists, led by Capt. Jean Ribaut, land at mouth of St. Johns River.
- 1564—Huguenots build Fort Caroline near St. Johns R.
- 1565—Pedro Menéndez de Avilés builds fort at St. Augustine, first permanent white settlement in what is now United States; Menéndez captures Fort Caroline for Spain; renames it Fort San Mateo.
- 1568—Dominique de Gourgues captures Fort San Mateo for France but Menéndez finally drives French out.
- 1573—Franciscans establish mission among Indians.
- 1586—Sir Francis Drake loots and burns St. Augustine.
- 1665—Enlarged Carolina grant by Charles II of England includes northern Florida; Spanish acknowledge part of English claims in treaty signed 1670.
- 1698—Spanish build Pensacola to prevent further French colonization in Florida.
- 1702—English from Carolina besiege St. Augustine for three months; withdraw in defeat.
- 1704—English from Carolina destroy Spanish missions.
- 1719—French capture Pensacola; Spanish regain it; French recapture it; return it to Spain, 1723.
- 1728—English from Carolina raid northern Florida.
- 1740—English from Georgia raid northern Florida.
- 1750—Creek Indians from Georgia migrate to Florida, where they become known as the Seminoles.
- 1763—Spain trades Florida to England for Havana, ending 150 years of conflict between Spanish Florida and English colonists. Florida divided into East and West Florida. North boundary fixed along St. Mary's, Flint, and Chattahoochee rivers and west to Mississippi River at 32° 30' N., 1764.
- 1768—Andrew Turnbull, with nearly 1,500 colonists, settles at New Smyrna in largest British colonial project ever made in North America; project fails, 1776.
- 1776—Florida remains loyal to Britain during revolution; many Tory families settle there.
- 1778—American army under Gen. Robert Howe invades Florida; British repulse attack.
- 1779—Spanish attack West Florida; occupy it, 1781.
- 1783—England cedes East and West Florida back to Spain; most English colonists move to West Indies; Spaniards invite American settlers.
- 1786—Spaniards open first free school in Florida at St. Augustine.
- 1795—Spain accepts 31st parallel as northern limit of Florida.
- 1812—Spain accepts Perdido River as Florida's western boundary. American settlers in East Florida form Republic of Florida; return to Spanish rule, 1816.
- 1814—Andrew Jackson seizes Pensacola to halt its use by British as base in War of 1812; invades West Florida again, 1818, to subdue Seminole Indians.
- 1819—Spanish agree to cede Florida to U.S. for \$5,000,000 in credit and cession of U. S. claims to Texas.
- 1821—Spain formally surrenders Florida to U. S.; Andrew Jackson takes possession as provisional governor.
- 1822—Territory of Florida established, March 30; William Duval, governor.
- 1824—Tallahassee selected as capital site.
- 1835—Dade Massacre starts seven-year Seminole War, most Indians are removed to western territory.
- 1838—Constitution for statehood framed at St. Joseph.
- 1841—Yellow fever kills most of St. Joseph's population.
- 1845—Florida admitted to Union, March 3, as 27th state, Tallahassee, capital; governor, William D. Moseley.
- 1850—U. S. Swamp Land Act gives state about 22,000,000 acres of land.
- 1852—First public school in state opens at Tallahassee State seminary chartered at Ocala; opens 1853, becomes University of Florida, 1905; opens 1906 at Gainesville. State Seminary chartered at Tallahassee; becomes Florida State College for Women, 1905, and Florida State University, 1947.
- 1855—State Internal Improvement Fund created.
- 1860—Florida Railroad is first to cross state, running from Fernandina to Cedar Keys.
- 1861—Florida is 3d state to secede from Union, Jan. 10.
- 1864—Battle of Olustee, February 20, saves middle Florida for Confederacy, leaving Tallahassee the only Southern state capital that was never captured.
- 1868—State readmitted to Union under new constitution, June 25; civil government restored, July 4. Cuban cigar makers set up factories at Key West; move industry to Ybor City (part of Tampa), 1886.
- 1881—Florida sells about 4,000,000 acres of land to financiers, who begin development of state.
- 1884—Pebble phosphate deposits found on Peace River.
- 1885—Present constitution framed; effective, 1887.
- 1887—Florida Agricultural and Mechanical University for Negroes founded at Tallahassee.
- 1888—Henry M. Flagler begins rail and tourist development of Florida; completes Jacksonville-Miami rail line, 1896; line extended to Key West, 1912.
- 1889—Hardrock phosphate discovered near Ocala.
- 1895—Severe freeze almost destroys citrus crops; industry forced to move southward.
- 1907—Draining operations begun in the Everglades.
- 1920—Land boom brings flood of settlers; many attracted by state prohibition of state income and inheritance taxes, 1924; boom bursts, 1926.
- 1924—First commercial planting of tung-oil trees made.
- 1926—Hurricane devastates part of Florida; second storm strikes, 1928.
- 1929—Commercial sugar milling begins at Clewiston.
- 1935—State Industrial Commission created. Hurricane destroys 38 miles of railway trestle between Florida City and Key West, September 20.
- 1937—Florida abolishes poll tax suffrage requirement.
- 1938—Miami-Key West 156-mile highway opened as longest "overseas" road in the world.
- 1947—Everglades National Park created.
- 1950—Worst hurricane in 24 years sweeps east coast.
- 1952—Voters accept amendment to state constitution earmarking part of auto-license revenue for next 30 years for school construction.
- 1953—State legislature approves 110-mile Sunshine State Parkway from Stuart to Miami. John E. Matthews Bridge of Jacksonville Expressway dedicated. Pres. Eisenhower signs off-shore oil bill giving Florida and other coastal states rights to submerged oil.

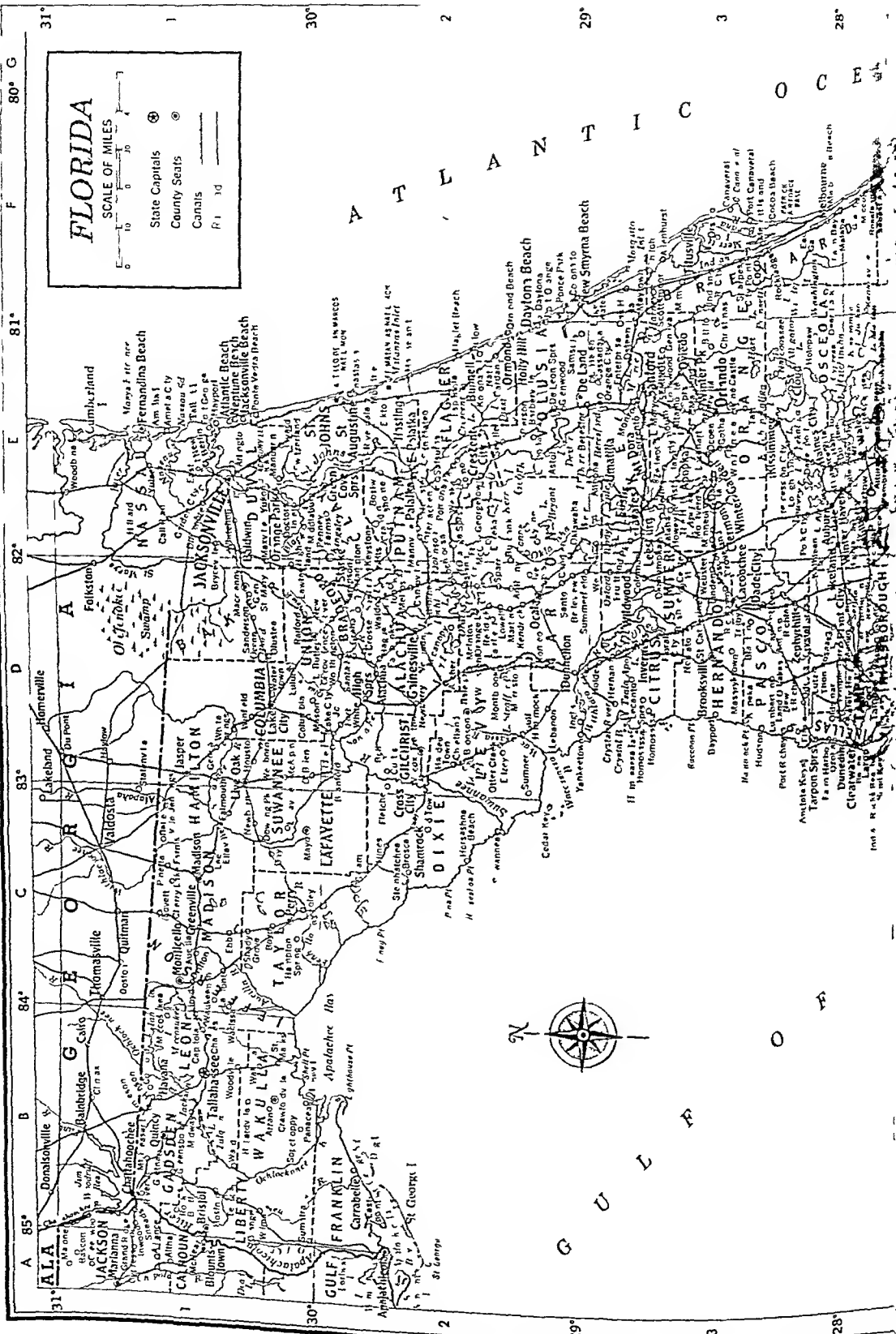
FLORIDA

COUNTIES

COUNTIES			COUNTIES			COUNTIES			COUNTIES					
Alachua	57 026	D 2	Anna Maria	345	D 4	Canaveral	F 3	Dunedin	3 202	D 3	Goulds	1 600	F 6	
Baker	6 313	D 1	Anthony	400	D 2	Candler	150	E 2	Dunnellon	1 110	D 2	Gracerville	1 638	D 2
Bay	42 689	C 6	Apalachicola	3 223	A 1	Lanstonmont	E 2	Eagle Lake	1 060	E 4	Gracem	60	D 2	
Bradford	11 457	D 2	Apopka	2 254	E 3	Capitola	150	B 1	Earleton	1 000	D 2	Grand Ridge	300	A 1
Brevard	23 653	F 3	Aracadia	4 784	E 4	Capitola	60	D 5	East Palatka	1 367	E 2	Grandun	200	E 2
Broward	83 933	F 5	Archer	586	D 2	Carrabelle	970	B 2	Eastpoint	600	B 2	Grant	200	F 4
Calhoun	7 922	D 6	Argyle		C 6	Caryville	525	C 6	Eastport	110	E 1	Green Cove		
Charlotte	4 266	E 5	Aripeka	75	D 6	Cassadaga	200	E 3	Reu Gallin	1 554	F 3	Springs	3 291	E 2
Citrus	6 111	D 3	Arlington	3 400	E 1	Cassberry	407	E 3	Ebb	100	C 1	GreenacresCity	531	F 5
Clay	14 332	E 2	Arran		D 1	Cedar Key	900	C 2	Ebro	200	C 6	Greensboro	565	B 1
Collier	6 488	E 5	Asatula	255	E 3	Center Hill	523	D 3	Edgewater	837	F 3	Greenville	1 163	C 1
Columbia	18 216	D 1	Astoria		E 2	Century	1 350	B 5	Edgewood	217	E 3	Greenwood		A 1
Dade	495 084	F 6	Atlantic Beach		E 1	Chaires		E 4	El Jobean	60	D 5	Gretba	385	B 1
Da Soto	9 242	E 4	Auburndale	1 604	E 1	Charlotte		E 1	El Portal	1 371	F 6	Groveland	1 028	E 3
Dixie	3 928	C 2	Aucilla	3 763	E 3	Harbor	330	E 5	Elkton	560	D 3	Gulf Breeze	287	B 6
Duval	304 029	E 1	Avon Park	4 812	E 2	Chalkaboocher			Elkton			Gulf Hammock		
Escambia	112 706	B 6	Baton Park	1 000	E 4	Cherry Lake	8 473	B 1	Ellaville	5	D 1		250	D 2
Flagler	3 367	E 2	Beachad	1 400	B 6	Farms	600	C 1	Ellenton	700	D 4	Gulf Stream	163	F 5
Franklin	5 814	B 6	Baker		C 5	Chickland	343	D 2	Elkay	150	D 2	Gunport	3 702	D 4
Gadsden	36 457	B 1	Bal Harbour	274	F 6	Chidley	2 959	D 6	Emporia	470	E 2	Gulf Point	65	B 6
Gilchrist	3 499	D 2	Baldwin	1 048	E 1	Chiklosken	143	E 6	Emmowood	1 206	D 5	Hague	150	D 2
Gladys	2 199	E 5	Barberville	350	E 2	Chono	1 673	F 5	Enterprise	300	E 3	Baines City	5 630	E 3
Gulf	7 460	D 7	Barribean Pk	200	B 6	Christina	250	E 3	Espanola	125	E 2	Ballandale	3 868	F 6
Hamilton	8 981	D 1	Barth	300	B 6	Citra	600	D 2	Estero	250	E 5	Bampton	386	D 2
Harden	10 073	E 4	Bartow	8 894	E 4	Citra Center	15	E 5	Esio	217	C 6	Bampton Sprs.	15	C 1
Hendry	6 051	E 6	Bascom	150	A 1	City Point	250	F 3	Eucaria	300	E 2	Harder Town		D 2
Hernando	6 693	D 3	Basinger	150	F 4	Clarksville		D 6	Eustis	4 005	E 3	Harold	73	B 6
Hillsboro	13 336	E 4	Bay Harbor	1 676	D 6	Cleawater	15 581	D 4	Everglades	625	E 6	Hastings	577	E 2
Hillsborough			Islands	295	F 6	Cleawton	2 183	E 3	Fairbanks	35	D 2	Havana	1 534	D 1
			Bay Springs		H 6	Cleveland	164	E 5	Fairfield	1 000	E 3	Hawthorne	1 058	D 2
Holmes	13 996	C 6	Bayport	300	E 1	Clewiston	2 499	E 5	Falmouth		C 1	Hernando	364	D 3
Indian R.	11 873	F 4	Bayshore	15	E 6	Cloud Lake	132	F 5	Felda	300	E 5	Hesperide	70	F 4
Jackson	64 465	D 5	Baytown	15	E 6	Cocoa	4 245	F 3	Felphers	649	F 4	Hialeah	19 676	F 6
Jefferson	10 413	C 1	Bayville	15	E 6	Cocoa Beach	246	F 3	Fernandina	4 420	E 1	Hialeah		F 6
Lafayette	3 440	C 2	Bean City	266	F 6	Coleman	819	D 3	Fernandina			High Spgs	2 088	D 2
LaFayette	3 440	C 2	Bea Ridge	500	D 4	Collier City			Fernandina			Highland	350	E 1
Lee	26 340	E 3	Bell	108	D 2	(Goodland)	337	E 6	Beach	654	E 2	Highland Beach	62	F 5
Leon	61 700	B 1	Belle Glade	7 219	F 6	Columbia	75	D 1	Flagler Beach	374	E 1	Highland City		
Levy	10 637	D 2	Belleme	661	D 4	Compas Lake		D 6	Fletcher	100	C 2		1 000	E 6
Lett	3 182	B 1	Belleview	595	D 2	Concord		D 1	Florahome	400	E 2	Highland Park	82	E 4
Madison	14 167	D 1	Bellville	20	C 1	Ceasar	100	E 2	Florida City	700	D 3	Hilbreth	23	D 2
Manatee	34 764	D 4	Bennet	100	D 6	Coral			Florence Villa			Hilbreth Heights	91	E 4
Marion	98 167	D 2	Berewood	100	E 2	Gables	16 837	F 6	Florida City	2 500	E 3	Hillard	607	E 1
Martin	7 807	F 4	Bucayna Pa.			Coreytown	23	D 4	Florida City	1 547	F 6	Hillsideville	26	B 1
Monroe	29 857	E 7	Bithlo	60	E 3	Corewell	10	E 4	Floridatown	1 200	D 6	Hillsideville	26	B 1
Nassau	12 911	E 1	Blanton	76	D 8	Coronado		F 2	Flores		B 6	Hillsideville	26	B 1
Oakalosa	27 633	C 6	Blountstown	2 118	A 1	Cortea	600	D 4	Foley	1 014	C 1	Hillsideville	26	B 1
Okeechobee	3 464	F 4	Blountsprings	100	B 6	Collagehill	500	B 6	Fort Barranca	300	D 6	Hillsideville	26	B 1
Orange	114 900	E 3	Boca Ciega	158	D 4	Cottendale	737	D 6	Fort Drum	50	F 4	Hillsideville	26	B 1
Ocala	11 406	E 3	Boca Grande	400	D 5	Craig	10	F 7	Fort George	150	E 4	Hillsideville	26	B 1
Palm Beach			Boca Raton	992	F 5	Crawfordville	625	B 1	Fort Green			Hillsideville	26	B 1
			Boca Raton	992	F 5	Crescent City			Fort Lauderdale			Hillsideville	26	B 1
			Bokella	100	D 6		1 393	E 2	Fort Lauderdale	36 324	F 5	Hillsideville	26	B 1
Pasco	20 529	D 3	Bonifay	2 282	C 6	Cressview	5 004	C 6	Fort McCoy	600	E 2	Hillsideville	26	B 1
Pinellas	159 249	D 4	Bonita Springs		E 6	Crown City	1 573	C 2	Fort Meade	2 401	E 4	Hillsideville	26	B 1
Polk	123 997	E 4	Bostwick	500	E 2	Cystal Lake	290	D 6	Fort Myers	13 195	E 5	Hillsideville	26	B 1
Putnam	23 615	E 2	Bowling Green	884	E 4	Cystal River			Fort Pierce	750	E 4	Hillsideville	26	B 1
Saint John	24 908	E 2	Bord	200	C 1		1 626	D 3	Fort Pierce	13 502	F 4	Hillsideville	26	B 1
Saint Lucie	20 180	F 4	Boynton			Cystal Sprs	250	D 3	Fort Pierce	13 502	F 4	Hillsideville	26	B 1
Santa Rosa	18 554	B 6	Beach	2 542	F 5	Curtis	50	D 2	Fort Walton Beach	2 463	C 6	Hillsideville	26	B 1
Sarasota	28 527	D 4	Bradenton	13 604	D 4	Cypress	262	A 1	Fort White	329	D 2	Hillsideville	26	B 1
Seminole	26 853	E 3	Bradenton			Dade City	6 808	D 4	Fountain	150	D 6	Hillsideville	26	B 1
Sumter	11 330	E 3	Beach			Dania	4 540	F 6	Freepoot		C 6	Hillsideville	26	B 1
Suwannee	16 986	D 1	Bradenton	500	D 4	Darlington		C 5	Frank	300	D 6	Hillsideville	26	B 1
Taylor	10 416	C 1	Bradenton	422	D 4	Davenport	769	E 3	Frank	300	D 6	Hillsideville	26	B 1
Union	8 906	D 1	Bradford	713	D 2	Davis	723	F 5	Frank	300	D 6	Hillsideville	26	B 1
Volusia	74 220	E 2	Brewster	50	E 4	Day	300	C 1	Frank	300	D 6	Hillsideville	26	B 1
Wakulla	3 258	B 1	Brighton	175	E 4	Daytona Beach			Frank	300	D 6	Hillsideville	26	B 1
Walton	14 725	C 6	Bristol	1 800	B 1		30 187	F 2	Frank	300	D 6	Hillsideville	26	B 1
Washington	11 885	C 6	Brownson	624	D 2	De Funiak			Frank	300	D 6	Hillsideville	26	B 1

CITIES AND TOWNS

Alachua	1 116	D 2	Brownville	200	E 4	De Soto City	229	E 3	Gibsonville	1 459	F 4	Inglis	200	D 2
Airford	375	D 3	Bruce	200	C 6	Deer Park	F 3	F 3	Gifford	128	F 5	Intermersion City	E 3	
Allenhurst	60	F 3	Bryant	400	F 5	Deerfield Beach	F 5	F 5	Glen Ridge	250	C 6	Interlachen	297	E 2
Audience	250	A 1	Bryerville	150	D 1				Glen Saint Mary	D 1	C 6	Inverness	1 471	D 3
AltamonteSprs	553	E 3	Bulow	25	E 2	Delray Beach	6 212	F 5	Glenwood	155	E 2	Inwood	100	A 1
Altha	434	A 1	Bunnell	1,341	E 2	Demand	100	C 6	Golfco Beach	156	F 6	Islamorada	600	F 7
Altosona	500	E 3	Burhamk	80	E 2	Destin		F 1	Gulfview	84	* F 5	Island Grove	400	D 2
Alturas	350	E 4	Burnell	536	D 3	Dismantel	1 610	E 1	Gomes	85	F 4	Jacksonville		
Alya	300	E 5	Caldero	29	D 6	Doctors Inlet	450	E 1	Gonzales	700	B 6		204 517	E 1
Amelia City	150	E 1	Callahan	722	E 1	Dover	1 000	D 4	Goodall	337	E 6	Jacksonville		
Anastasia	500	E 2	Campbellton	307	F 5	Dorvaling Park	35	C 1	Gotha	275	C 3	Beach	6 430	E 1
Annapolis	150	E 2	Campville	250	D 2	Drifton	200	C 1	Goulding	300	B 6	Jamison	120	B 1
			Carroll	307	F 5	Dundee	1 252	E 2						



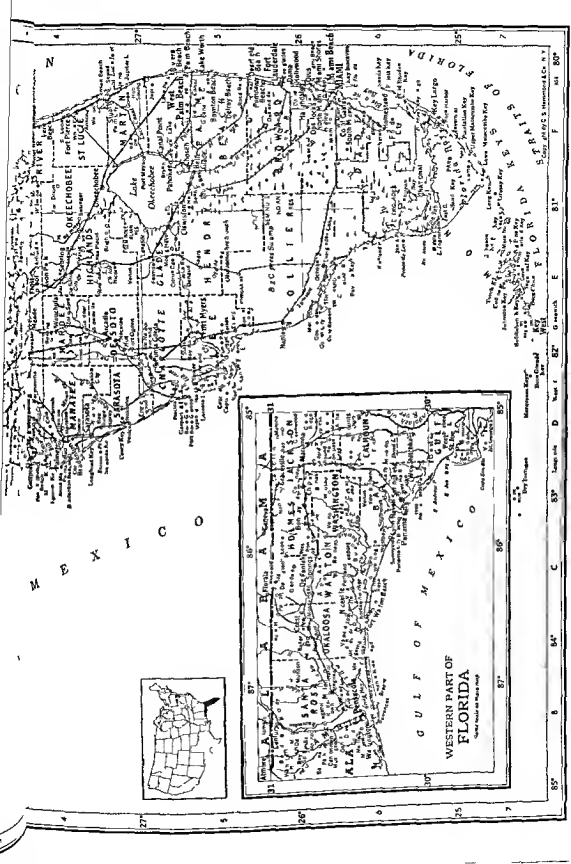
FLORIDA

SCALE OF MILES



- State Capitals
- County Seats
- Canals
- Railroad





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G U L F O F M E X I C O

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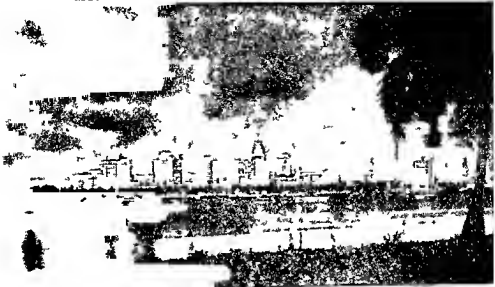
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FLORIDA—Continued

Jasper	2,327	D 1	Marianna	5,845	A 1	Odessa		D 3	Princeton	1,300	F 6	Sunnyside	85	C 6
Jay	547	B 5	Marineland	9	E 2	Ojus	3,791	F 6	Providence	16	D 2	Sunshine Beach		
Jennings	549	C 1	Martin	100	D 2	Okahumpka	450	D 3	Punta Gorda	1,915	E 5		469	*D 4
Jensen Beach		F 4	Mary Esther	332	B 6	Okeechobee	1,849	F 4	Punta Rassa	25	E 5	Surfside	1,852	*F 6
Johnson		E 2	Masaryktown	190	D 3	Oklawaha	500	E 2	Quincy	6,503	B 1	Suwannee	125	C 2
Jupiter	313	F 5	Mascotte	440	E 3	Old Town	300	C 2	Ralford	40	D 1	Sweetwater	230	*F 6
Kathleen	750	D 3	Mason	20	D 1	Oldsmar	345	D 3	Raleigh	156	D 2	Switzerland	350	E 1
Kenansville	250	F 4	Maxville	500	E 1	Oliver	200	B 6	Redbay	250	C 6	Taft	800	E 3
Kendall	2,100	F 6	Mayo	679	C 1	Olustec		D 1	Reddick	433	D 2	TALLAHASSEE		
Kendrick	600	D 2	Mayport	1,300	E 1	Ona	89	E 4	Redington Beach				27,237	B 1
Key Largo	60	F 6	Maytown	25	F 3	Oneco	650	D 4		384	*D 4	Tampa	124,681	D 4
Key West	26,433	E 7	McAlpin	100	D 1	Opal-Locka	5,271	F 6	Richland	100	D 3	Tarpon Sprs.	4,323	D 3
Keystone Hts.	307	E 2	McDavid	700	B 5	Orange		B 1	Richloam	10	D 3	Tavares	1,763	E 3
Keysville	500	D 4	McIntosh	247	D 2	Orange City	797	E 2	River Junction		B 1	Tavernier	450	F 6
Kinard	300	D 6	McNeal	500	A 1	Orange Lake	500	D 2	Riverdale	100	E 2	Telogia		B 1
Kissimmee	4,310	E 3	Medley	106	*F 6	Orange Park	1,502	E 1	Riverview		D 4	Temple		
Korona		E 2	Melbourne	4,223	F 3	Orange Springs	275	E 2	Riviera			Terrace	433	D 3
Kynesville	400	D 6	Melbourne			Orlando	52,367	E 3	Beach	4,065	F 5	Terra Ceia	1,500	D 4
La Belle	945	E 5	Beach	230	F 3	Ormond	3,418	E 2	Rock Bluff	250	B 1	Thonotosassa	2,500	D 3
La Crosse	146	D 2	Melrose	750	D 2	Ormond Beach	900	F 2	Rock Harbor	185	F 6	Tice	1,133	E 5
Lacoochee	1,792	D 3	Merritt Island		F 3	Orsino	55	F 3	Rockledge	1,347	F 3	Titusville	2,604	F 3
Lady Lake	331	E 3	Miami	249,276	F 6	Oscola		E 3	Romeo	300	D 2	Treasure Island	75	*D 4
Lake Alfred	1,270	E 3	Miami			Osprey	350	D 4	Roseland	100	F 4	Trenton	904	D 2
Lake Butler	1,040	D 1	Beach	46,282	F 6	Osteen	300	E 2	Round Lake	250	D 6	Trilby	500	D 3
Lake City	7,571	D 1	Miami Shores	5,056	F 6	Otter Creek	1,050	D 3	Ruskin		D 4	Uleta	700	F 6
Lake City Jct.	11	D 2	Miami Sprs.	5,105	F 6	Overstreet	100	D 6	Safety Harbor	894	D 4	Umatilla	1,312	E 3
Lake Como	200	E 2	Micanopy	612	D 2	Oviedo	1,601	E 3	Saint			Useppa Island	25	D 5
Lake Hamilton	604	E 3	Mico	250	F 4	Oxford	304	D 3	Angustine	13,555	E 2	Valparaiso	1,047	C 6
Lake Harbor	800	F 5	Micoosukee	160	B 1	Ozona	600	D 3	St. Catherine	250	D 3	Venice	727	D 4
Lake Helen	926	E 3	Middleburg	500	E 1	Pahokee	4,472	F 5	Saint Cloud	3,001	E 3	Venus	35	E 4
Lake Jem	300	E 3	Midway	500	B 1	Palatka	9,176	E 2	Saint James			Vernon	610	C 6
Lake Maitland	889	*E 3	Millers Ferry	40	C 6	Palm Bay	300	F 3	City	35	E 5	Vero Beach	4,746	F 4
Lake Mary	500	E 3	Milligan	600	C 6	Palm Beach	3,886	G 5	Saint Leo	261	D 3	Villa Tasso	75	C 6
Lake Monroe	300	E 3	Millview	150	B 6	Palm City		F 4	Saint Lucie	300	F 4	Virginia		
Lake Park	469	F 5	Mill	2,040	B 6	Palm Harbor	750	D 3	Saint Marks	391	B 1	Gardens	235	*F 6
Lake Placid	417	E 4	Mims	1,500	F 3	Palma Sola	300	D 4	Saint Peter			Wabasso	300	F 4
Lake Wales	6,821	E 4	Minneola	399	E 3	Palmdale	82	E 5	Saint Petersburg	96,738	D 4	Wadessa	450	B 1
Lake Worth	11,777	G 5	Molokai	600	B 6	Palmetto	4,103	D 4	Beach			Wakulla		B 1
Lakeland	30,851	D 3	Montbrook	200	D 2	Panacea		B 1	Beach	722	*D 4	Waldo	647	D 2
Lakeport	70	E 5	Monticello	2,264	C 1	Panama City	25,814	C 6	Salem	200	C 2	Walnut Hill		B 5
Lakeview		C 5	Montverde	293	E 3	Panama City			Salerno	789	F 4	Walton	175	F 4
Lamont		C 1	Moore Haven	636	E 5	Beach		C 6	Samoset	1,617	D 4	Ward	30	B 1
Land O'Lakes	75	D 3	Morrison	150	D 2	Paola	400	E 3	Samson	125	D 2	Warrington	13,570	B 6
Lantana	773	F 5	Mossy Head	125	C 6	Parker		D 6	Samsula	500	E 2	Watertown	1,473	D 1
Largo	1,547	D 4	Moultrie	50	E 2	Parris	1,200	D 4	San Antonio	256	D 3	Wauchula	2,872	E 4
Landerdale-by-the-Sea	234	*F 5	Mount Dora	3,028	E 3	Parris			San Carlos		E 5	Waukeenhah	200	C 1
Laurel	500	D 4	Mt. Pleasant	300	B 1	Pass-a-Grille			San Mateo	750	E 2	Wausau	350	D 6
Laurel Hill	327	C 5	Mulat	80	B 6	Beach	1,000	D 4	Sanderson	100	D 1	Waverly	1,000	E 4
Lawley	576	D 1	Mulberry	2,024	E 4	Paxton	300	C 5	Sanford	11,935	E 3	Webster	569	D 2
Lebanon	75	D 2	Murdoch	300	B 5	Pelican Lake		F 5	Sanibel	125	D 2	Weirsdale	800	D 3
Lecanto	182	D 3	Murdock	100	D 4	Pembroke	50	E 4	Santa Fe	100	D 2	Welaka	459	E 2
Lee	228	C 1	Muscogee	165	B 6	Penney Farms	445	E 2	Santa Rosa	300	C 6	Wellborn	450	D 1
Leesburg	7,395	E 3	Myakka City	450	D 4	Pennsuso	133	*F 6	Santos	100	D 2	West Miami	4,043	F 6
Leonia	103	C 5	Myrtle Grove		E 5	Pensacola	43,479	B 6	Sarasota	18,696	D 4	West Palm		F 5
Limestone	150	E 4	Naples	1,465	E 6	Perrine	2,859	F 6	Scattusa	250	E 2	Beach	43,162	F 5
Linden	250	D 3	Naranja	500	F 6	Perry	2,797	C 1	Scotsmoore	150	F 3	Westbay	400	C 6
Live Oak	4,064	D 1	Narcoossee	120	E 3	Pierce	975	E 4	Sears		E 5	Westgate	3,303	F 6
Lloyd	325	C 1	National			Pierion	657	E 2	Sebastian	376	F 4	Westville	428	C 6
Lockloosa	200	E 2	Gardens	125	E 2	Pine Castle	2,000	E 3	Sebring	5,006	E 4	Wewahatchka		
Lockhart	1,200	E 3	Neptune Beach			Pineland	50	D 5	Seffner	850	D 4		1,289	D 6
Longwood	717	E 3	New Berlin	1,767	E 1	Pinellas Pk.	2,924	D 1	Seville	427	E 2	White City	750	F 4
Lorida	225	E 4	New Port	100	E 1	Pinetta	250	C 4	Shady Grove	50	C 1	White Springs	700	D 1
Loughman	350	E 3	Richey	1,512	D 3	Placida		E 7	Shallmar	694	*C 6	Whitehouse	175	E 2
Lovett	18	C 1	New River	150	D 2	Plant City	9,230	D 3	Shamrock	700	C 2	Wilcox	125	D 2
Lowell	150	D 2	New Smyrna			Plymouth	300	E 3	Sharps	300	F 3	Willwood	2,019	D 2
Loxahatchee	200	F 5	Beach	5,775	F 2	Point Washington		C 6	Shiloh	150	F 3	Williston	1,323	D 3
Lulu	100	D 1	Newberry	873	D 2	Polk City	171	E 3	Silver Springs	350	D 2	Wilma	50	B 1
Lumberton	25	D 3	Newburn	10	C 1	Pomona Park	443	E 2	Slater	25	E 5	Wilton Manor	883	*F 5
Luraville	20	C 1	Niceville	2,497	C 6	Pompano Beach			Sneads	1,074	B 1	Wimauma	440	D 4
Lutz	1,800	D 3	Nichols	550	E 4				Sopchoppy		B 1	Windermere	317	E 3
Lynn Haven	1,787	C 6	Novelton	72	D 3	Ponce de Leon	600	C 6	Sorrento	300	E 3	Winfield	100	D 1
Lynne	125	E 2	Nocatee	1,200	E 4	Ponce Park	39	F 2	South Bay	1,050	F 5	Winter Beach	350	F 4
MacClenny	1,177	D 1	Nokomis	800	D 4	Fonte Vedra			South Daytona	692	E 2	Winter Garden		F 3
Madefira Beach	916	*D 4	Noma		C 5	Beach	1,000	E 1	South Flomatin				3,503	E 3
Madison	3,150	C 1	North Bay	198	*F 6	Port Boca			South Miami	4,809	F 6	Winter Haven		F 3
Maitland	940	E 3	No Miami	10,734	F 6	Grande	75	D 5	Southport	825	C 6	Winter Park	8,250	E 3
Malabar	375	F 3	North Miami			Port Canaveral		F 3	Sparr	450	D 2	Woodville		B 1
Malone	521	A 1	Beach	2,129	F 6	Port Everglades			Springfield	1,084	D 6	Worthington	30	D 2
Manalapan	54	*F 5	Oak Hill	683	F 3				Starke	2,944	D 2	Yalaha	600	E 3
Manatee		D 4	Oakland	548	E 3	Port Mayaca	100	F 5	Steinhatchee	900	C 2	Yankeetown	322	D 2
Mandarin	800	E 1	Oakland Pk.	1,295	F 5	Port Orange	1,201	F 2	Stuart	2,912	F 4	Youngstown	500	D 6
Mango	350	D 4	O'Brien	300	D 1	Port Richey	376	D 3	Sumatra		B 1	Yukon	2,000	E 1
Mangonia Park	348	*F 5	Ocala	11,741	D 2	Port St. Joe	2,752	D 6	Summerfield	400	D 2	Yulee	500	E 1
Mannville	70	E 2	Ocean Ridge	67	*F 5	Port Seawall	210	F 4	Summerland Key	3	E 7	Zellwood	1,500	E 3
Marathon	1,200	E 7	Ochopee	300	E 6	Port Tampa	1,497	D 4	Summer	25	D 2	Zephyrhills	1,826	D 3
Marco	250	E 6	Ocoee	1,370	E 3	Portland	350	C 6	Sun City	325	D 4	Zolfo Springs	334	E 4

*No room on map for name.

MIAMI'S STRIKING SKYLINE AT DUSK



As night falls, brilliantly lighted buildings make dramatic contrasts which are reflected in the palm-lined waters of

Biscayne Bay. Miami, the largest city of Florida, is also a great business resort and airport center.

out the state. The rainy season comes in June, July and August, but the winters are comparatively dry. Such ideal conditions attracted more and more winter visitors as Florida developed into a pleasure resort.

Lack of transportation at first handicapped Florida as a resort state, but this was overcome largely by the efforts of two men—H. B. Plant, who from 1879 to 1899 developed the Plant system of railroads (now the Atlantic Coast Line), focusing upon Tampa and Henry M. Flagler, who from 1885 to 1912 developed the Florida East Coast Railway. The latter line extends south from Jacksonville along the eastern coast. These, with the Seaboard Air Line and a network of smaller lines, penetrate the rich fruit and vegetable districts of central Florida. The prosperity of east coast resorts, such as Ormond Beach, Daytona Beach, Palm Beach, and Miami, followed soon after the railroads.

Plant and Flagler also built luxurious hotels to attract tourists to their respective zones of activity. Plant likewise established steamship lines and developed port facilities at Tampa. Today Tampa is the third largest city in the state.

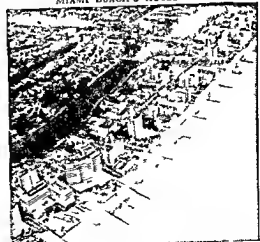
Inland waterways have been unimproved. The Florida Intracoastal Waterway provides sheltered passage down the east coast from Cumberland Sound south to Miami. Rivers and lakes have been linked by canals to provide a cross-state route between St. Lucie Inlet and Fort Myers.

A great impetus to Florida's growth came after World War I. In 1924 the state passed a constitutional amendment prohibiting state income and inheritance taxes. National attention was turned to Florida and its many advantages, and the result was an extraor-

dinary land rush, or boom, which drew thousands of people to the state.

Real estate soared in price. Whole towns were built upon what was once a swamp or forest land, and sand was pumped from the ocean upon low-lying shores for additional home sites in the most popular locations. When Florida took its 1925 census, many cities had more than doubled in population since 1920. From 1940 to 1950, another period of rapid growth, the state's population increased 48.1 per cent.

MIAMI BEACH'S HOTEL ROW

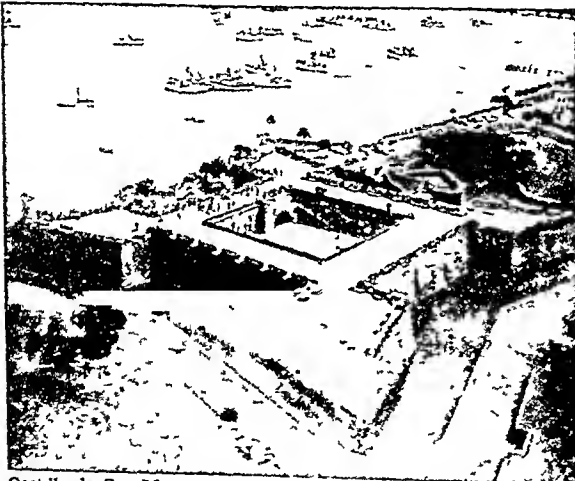


Miami Beach, one of the world-famed resorts, is across Biscayne Bay from Miami. Palatial hotels, cabanas, and miles of sandy beach line the ocean front of this fabulous playground.

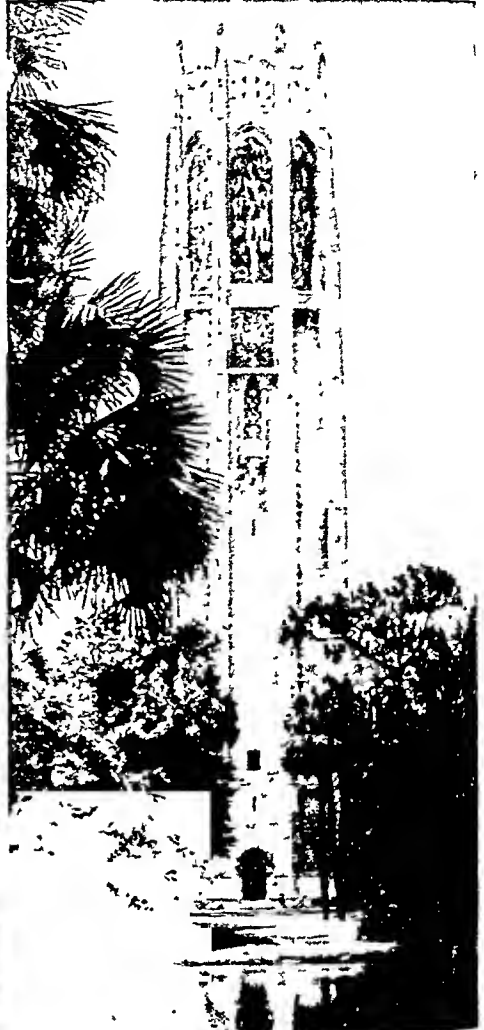
THERE IS MUCH TO SEE IN THE "PENINSULA STATE"



The nation's Oldest House, built before 1599 in St. Augustine, displays flags of the United States, Confederacy, England, and Spain.



Castillo de San Marcos National Monument is in St. Augustine. It preserves the oldest existing masonry fort in the United States.



Bok Singing Tower is in Mountain Lake Sanctuary near Lake Wales. In the 205-foot carillon tower are 71 bells.

Florida abounds in birds and other wild creatures, many of them remarkable for their beautiful color or strange forms. Pumas, or cougars, still lurk in wilder parts of southern Florida and in swamps bordering the Everglades. Deer, otter, and raccoon are numerous. Crocodiles and alligators inhabit the water.

Man-o'-war birds sail gracefully along the seashore. Clownish brown pelicans engage in aerial drills or dive for fish. Coots and purple gallinules crowd ponds and lakes, and wailing limpkins give a weird charm to swamps. White ibises, the stork, known as the wood ibis, egrets, and water turkeys (anhingas) are plentiful.

In south central Florida the trumpeting of sand-bill cranes echoes across the prairies. In southern Florida the Everglade lute sails low over lakes and streams in search of fresh-water snails. Here too

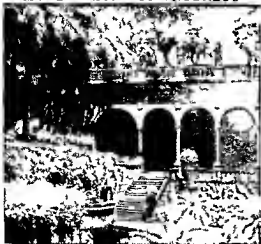
large numbers of great white herons stand knee-deep in water. The rare roseate spoonbill is found nowhere except in the southern tip of Florida.

The Famous Tower That Sings

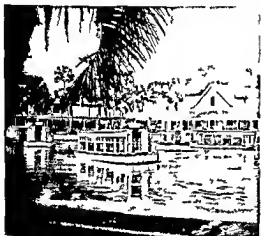
To give refuge to these birds and to provide a retreat of natural beauty, Edward W. Bok in 1929 gave Mountain Lake Sanctuary, with its beautiful Singing Tower, to the American people. This preserve occupies 53 acres of land including Mountain Lake and Iron Mountain, one of the highest points in Florida. It is in the center of the state east of Lakeland.

The Singing Tower is a symphony in pink marble and coquina rock rising 205 feet from the edge of a clear pool and gradually tapering from its 51-foot gray creole marble base to a width of 37 feet at the top. Pelicans, doves, eagles, herons, and other birds typical of America appear in the carvings. Panels de-

MORE PLACES OF INTEREST



The John and Mable Ringling Museum of Art built in Italian Renaissance style in Sarasota has a fine Rubens collection



Silver Springs near Ocala is one of the largest springs in the world. Glass bottomed boats permit views of underwater life

signed with roses and palms crown the octagonal summit. A heron perches on each of the eight buttresses. Near the very top of the tower is the carillon of 71 bells weighing 123,264 pounds.

To make the surroundings more beautiful birds and rare plants have been brought to the sanctuary. Nightingales came from England. Flamingoes common in Florida but driven out by plume hunters have been imported. Scarlet flamingoes were brought from Andros Island, Cuba, and white flamingoes from South America. A medley of foreign plants greets the botanist—strange orchids from tropical Asia, flame vines, cattleya, guava, duranta, white bauhinias, acacias and many others.

The Land Surface of Florida

Only one state, Delaware, has an average elevation above sea level lower than that of Florida. Yet

there is considerable diversity in topography. Limestone rock underlies the soil which is basically sand patched with the comparatively thin vegetable mold of the pine lands and the thick peatlike muck of the swamps.

Rolling hills from 200 to 300 feet above sea level prevail over the northern part of Florida. A ridge running north and south divides the east coast river system from those of the western coast.

Innumerable lakes and ponds especially in the central portion of the Florida peninsula fill the troughs between ridges and plateaus. Many of the more than 30,000 lakes in the state owe their origin to the soluble limestone that lies underneath them. Other lakes fill depressions in the floor of the sea that once covered the coastal terraces. Lake Okechobee, the second largest body of fresh water that lies wholly within the United States, occupies an old sea bottom on the northern border of the Everglades. Other lakes such as Lake Pinsett at the head of the St. Johns River are probably remnants of coastal lagoons like the Indian River and Lake Worth on the eastern coast.

Surface waters saturated with carbonic acid from decaying organic matter have etched great subterranean drainage channels in the limestone formations and have given rise to the lands of springs. The largest of these is Silver Springs at the head of the Silver River, a tributary of the beautiful Oklawaha. This spring discharges about 370,000 gallons a minute and ranks as one of the largest springs in the country.

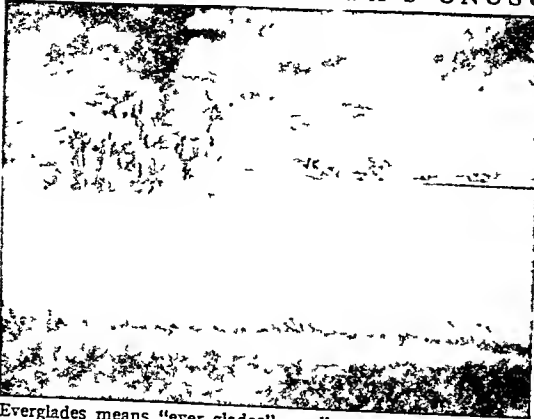
One of the numerous river systems, the St. Johns flows north parallel with the eastern coast for 300 miles before it drains into the Atlantic near Jacksonville. Draining into the Gulf of Mexico are the Suwannee which rises in Georgia, and the Apalachicola, a continuation of the Chattahoochee River.

Swamps are common in many parts of the peninsula. The beautiful Okefenokee Swamp extends into northern Florida from Georgia. Sloping southward from Lake Okechobee are the Everglades, a vast flooded prairie about 110 miles long and 45 miles wide. Part of this region is densely forested, but most of it is thick, spongy water-soaked muck covered with clumps of saw grass. The northern part of the Everglades is being reclaimed by the state and the federal government. In 1907 construction began on canals draining from Lake Okechobee to the ocean. Now thousands of acres of rich land yield citrus fruits, vegetables, sugar cane, rice and other crops.

Everglades National Park

Everglades National Park at the southern tip of the Florida peninsula was established in 1947. The federal government gradually acquired title to more lands. Now the park is the second largest national park in the continental United States, ranking next to Yellowstone. Parts of the swampy wilderness have never been explored. On the west the open island-studded prairies merge into the Big Cypress Swamp which is crowded with the giant relatives of the famous California aquatics. The southernmost point of

FLORIDA'S UNUSUAL SOUTHERN TIP



Everglades means "ever glades"—endless expanses of grass. This tropical marshland in southern Florida is a national park.



The Overseas Highway, the world's longest ocean-going road, hops island to island on its way from the mainland to Key West.

the park is Cape Sable, 350 miles farther south than Cairo, Egypt. Here mangrove trees from 60 to 100 feet high rise like cliffs out of the Gulf of Mexico. In this region huge sea turtles come ashore to lay their eggs, and at low tide oysters may be seen clinging to the trunks of the mangroves.

Just to the north of Everglades National Park is Collier-Seminole State Park. The tallest royal palm tree in Florida, 90 feet high, is in this park.

Forests of mahogany and wild fig, *lignum vitae*, and rubber, interlaced with strong trailing vines and 18 species of air plants, form an almost impenetrable barrier. Twenty-five varieties of orchids have been discovered, some plants bearing as many as 1,000 flowers and estimated to be 500 years old. With Seminole Indians as guides you may travel for hundreds of miles through a maze of waterways to study the rare birds, fish, and animals of these wilds.

A few Indians and whites live in this tangle of streams and lagoons. After the close of the Seminole War in 1842, a few hundred members of the tribe escaped removal to reservations west of the Mississippi

by fleeing to the inaccessible heart of the Everglades. Their descendants still live here, poling their boats through the dense saw grass, hunting deer and other game, fishing, and tilling little plots of the rich island soil. The Seminoles (whose name means "runaway" or "seceder") still retain many primitive customs through their inaccessibility and strict tribal laws.

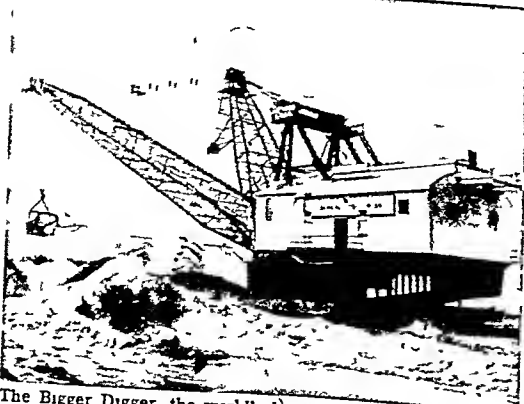
Florida's Leading Cities

Jacksonville is the northern industrial center of Florida. It is on the St. Johns River about 20 miles from the Atlantic Ocean. St. Augustine is the oldest city in the United States. Tallahassee, the capital, is a wholesale distributing center for the northwestern farming region of the state, and it manufactures lumber and wood products. Orlando and Lakeland are centers of rich fruit-growing district. Palm Beach, the resort of fashion, and Miami, a mecca for winter tourists and an important grapefruit and truck-garden center, are on the southeast coast. Pensacola, the second oldest city in the state, has the finest harbor on the Gulf of Mexico. A naval air-training station is situated there. Tampa is the most important commercial city on the Florida Gulf Coast. St. Petersburg, the "sunshine city," on the west coast is one of the country's great salt-water fishing resorts. Key West, long known as a cigar-making center, is now more important as a winter resort. It is also the country's closest link with Cuba, which is only about 100 miles across Florida Strait. (See also Jacksonville; St. Augustine; Tallahassee; Miami; Tampa; St. Petersburg; Key West)

Education and Government

The University of Florida is at Gainesville. Other important institutions of higher education are the Florida State University at Tallahassee; Florida Southern College, a Methodist institution at Lakeland; Stetson University, a Baptist university at De Land; Rollins College, famous for its interesting progressive methods, at Winter Park; the University of Miami at Coral Gables; and the University of Tampa at Tampa. Institutions for the higher education of Negroes include the Florida Agricultural and Me-

LEADING MINER OF PHOSPHATE ROCK



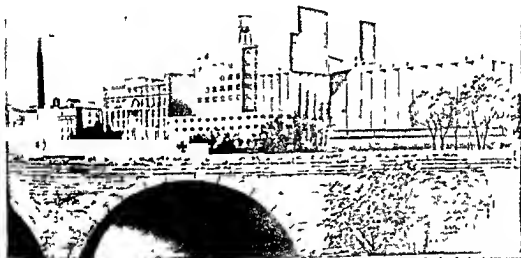
The Bigger Digger, the world's largest dragline near Bartow, helps Florida mine the most phosphate rock in the nation.

chanical University for Negroes at Tallahassee and the Bethune Cookman College at Daytona Beach. There is also a school for the deaf and blind (established in 1883) at St. Augustine.

Florida's present constitution was framed in 1885 and made effective in 1887. The executive officers are the governor, secretary of state, attorney general, comptroller, treasurer, superintendent of public instruction, and commissioner of agriculture. The governor, elected for a four-year term, may not succeed himself. In the state legislature the senate has 33 members elected for four years, and the house of representatives has 95 members elected for two years. (See also United States, section "The South.")

FLOUNDER This name is given to a number of food fishes of the flatfish group totaling about 500 species. The "summer flounder" or plaice (*Paralichthys dentatus*) is most abundant in shallow sandy bottoms about Long Island. It may reach a weight of 26 pounds but is usually much smaller. The "winter flounder" (*Pseudopleuronectes americanus*) found from Chesapeake Bay to Labrador is about half the size of the summer flounder. Other flounders on the East coast are the dab, gray sole, yellowtail and lemon sole. Common Pacific coast species are the petrale sole, starry flounder, and rex sole. Most flounders are marketed as "fillet of sole." True English sole is not found in American waters. (See Flatfish.)

FROM Golden WHEAT to Snow-White FLOUR



This is one of the great flour mills at Minneapolis, with the Mississippi River in the foreground. The immense concrete cylinders are the grain elevator bins. They store wheat until

it is needed for grinding. Different kinds of wheat are used in making blends of flour. Such huge combinations of elevators and mills are to be seen in most American milling centers.

FLOUR AND FLOUR MILLING The golden wheat or dark rye as it comes from the fields must be changed into flour before bread, our principal article of food, can be made from it. The long and complex process of grinding the kernels into flour and separating the fine flour from the coarser portions is called "milling."

In early times a stone was hollowed out and used as a base. A smaller stone, with one end rounded, was used to pound the grain into bits. These bits were mixed with water, patted into shape, and baked on a hot stone (see Bread and Baking). Later a hand mill called a *quern* was used. This consisted of two disks of stone, one on top of the other, with a hole in the middle through which the grain was fed in. The upper stone was rotated on the lower by means of

a handle. Next came comparatively large mills made on the same plan, with stones with grooved surfaces to give a cutting edge. These stones were turned by oven, water power, or windmills. The millers worked long, dusty hours turning the grain into flour.

Such mills as these formed part of every great feudal estate in the Middle Ages. To them the villagers had to go to grind their grain, paying their lord a fee for the privilege. In the early days of the United States boys often rode long distances, perched atop a bag of grain on horseback, to some gristmill where the family flour or meal was ground. They waited until the grinding was completed, then rode back with a sack of flour as a saddle. This system of milling can still be found in primitive communities in Asia and Africa.

The "roller process," by which nearly all grain is ground today, was brought in from Hungary in 1870 to grind the hard wheats then being introduced in the West. The new process was needed because millstone grinding cannot make white flour from hard wheat. Steel rollers with grooved surfaces squeeze the flour from the wheat berries as they turn against each other, but leave the germ and husk large enough to be separated easily. Thus the "patent" roller process flour of today is whiter than the stone-ground flour of our grandfathers.

The word flour by itself ordinarily means wheat flour. Other flours are named for the cereals from which they are made, as rice flour, rye flour, etc. Wheat flour contains gluten, a substance which does not occur to the same extent in other cereal grains. It is this which makes dough sticky and elastic, so that it will retain the bubbles

of gas formed by yeast or baking powder and thus rise and become light.

Before we can fully understand milling we must

IT GROUND THE GRIST OF OTHER DAYS



This is what is left of a granite gristmill which is at least 300 years old. The wooden pulley was turned by a belt driven by a water wheel. The grinder was originally supported by a wooden frame and the grain was crushed between the two stones.

know just how a grain of wheat is made up. We all know that it is an oblong little gram with a furrow down one side. On the outside is the brownish husk, called bran, consisting of layers of woody fiber. Within this husk lies the white kernel, composed chiefly of gluten and starch, from which white flour is made. Tucked away in one end of this kernel is the wheat heart or seed-germ, which, if the grain were planted, would produce the new plant. In

the milling, the bran and most of the seed-germ must be removed from the starchy white kernel in order to obtain a fine white flour.

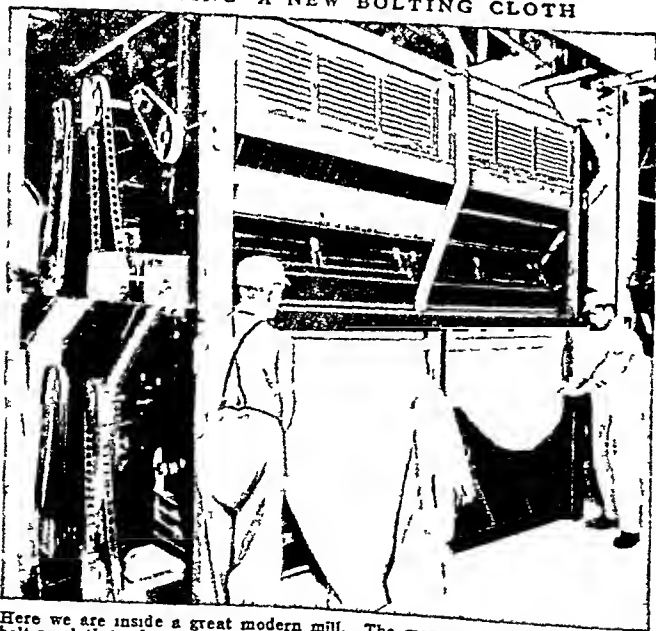
Let us see how flour is prepared in the big modern mills. These are usually eight or nine stories high,

and are so arranged that one part of the process is done on one floor and the next on the floor just beneath, so that gravity can be used to convey the grain from one machine to the other.

When the grain first comes to the mill it may contain dirt, particles of straw, and other seeds. These must all be removed before the grinding begins. This is done by sifting and shaking the grain and fanning it with strong currents of air. A special machine removes cockle-burs. The wheat grains are scoured bright and clean in a rapidly whirling cylinder. Then they are moistened with water or steam to toughen the coats of bran, so that when the grains are crushed these coats may more easily be separated from the flour.

When the grain is in the proper condition, it passes into what are known as the first break rolls. These rolls have coarse corrugations which crush but do not pulverize the grains. After a few crushings and while the stock is still coarse (it is called "middlings" at this point), strong air currents remove much of the bran. The machine per-

ATTACHING A NEW BOLTING CLOTH



Here we are inside a great modern mill. The men are attaching a new silk bolting cloth to the revolving cylinder of a reel. This cloth acts as a sieve in separating the fine flour from the coarser bits of the grain.

THESE ARE THE BREAK ROLLS



The task of these machines is to break the shell of the grain after which they pass on through other sets of rolls each adjusted to grind the grain a little finer

forming this task is called a middlings purifier. The middlings now pass through a series of pulverizing rolls each of which grinds the stock a little finer than its predecessor. After each grinding the stock goes into giant sifters (bolters) which are equipped with layers of vibrating screens through which the flour passes. These bolting screens are made of silk woven with 110 to 130 threads to the inch and stubborn bits of bran and other tailings are caught in them. This process of grinding and sifting is repeated over and over until all the wheat has been reduced to flour or its by products. The last machine feeds the flour into containers ready to go to the bakery, the grocery store or to be shipped abroad. Although only an hour may have elapsed from the time the wheat reached the mill until it is ready for shipment as flour it may have gone through as many as 175 siftings and separations.

Types and Grades

Whole wheat or graham flour (named for Sylvester Graham) contains all the cleaned grain that is the bran and germ as well as the white

flour. When the bran and the germ are removed to make white flour, an excellent source of iron and the vitamins thiamin, riboflavin and nicotinic acid is lost. Millers therefore agreed in 1940 to enrich their white flours by adding certain amounts of these substances. (See Bread and Baking.)

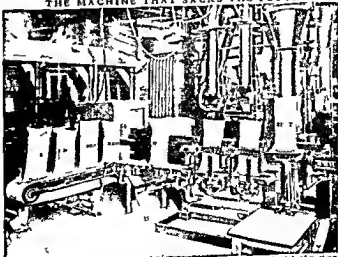
White flours are usually classified as *straights*, *patents* and *clear*. Straight flour contains about 70 per cent of the berry. Patent flours are refined until they may contain only 56 per cent of the berry. These grades are the American favorites for home and bakery use. For the finest patent flour about 25 per cent of the lowest grade is extracted. The extracted flour is called *clear*. Much of it is used in flours which are exported to Europe.

Yield and Consumption of Flour

Modern American milling averages one 196-pound barrel of flour from every 4.6 bushels of wheat. Since flour contains about 70 per cent of the berry, one 60-pound bushel of wheat will yield about 42 pounds of flour. About 13 ounces of flour are needed to make a one-pound loaf of bread.

Flour is milled throughout the United States at convenient points along transportation routes between areas of greatest supply and demand. Minneapolis is such a point. It has the additional advantage of cheap power from the Falls of St. Anthony and for many years Minneapolis was the greatest milling center in the country. But in 1930 Buffalo passed Minneapolis because of low shipping rates on the Great Lakes, cheap electric power nearness to consumer markets and the opportunity to mill Canada's export wheat in bond. Kansas City, Kan. and Kansas City, Mo., considered together also have surpassed Minneapolis as a milling center.

THE MACHINE THAT SACKS THE FLOUR

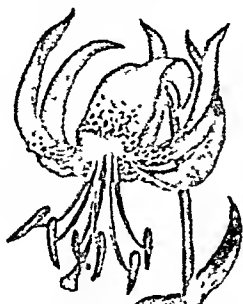


When the process of converting the wheat into flour is completed, the job of putting the finished product into the sacks is turned over to the flour packing machine, one of which is shown here. This machine automatically weighs the flour, putting the exact amount required into each sack. And it doesn't even stop there. It sews up the sacks flour tight.

The BEAUTY and the IMPORTANCE of FLOWERS



WILD ROSE



TURK'S-CAP LILY



MORNING-GLORY



NEW ENGLAND ASTER

The flower blossoms above show the great variety of flower forms—the simple petals of the rose; the backward curved petals of the Turk's-cap lily, the funnel-shaped morning-glory, and the grouping of many individual flowers to make the composite aster.

FLOWERS. The color, the perfume, the dainty forms of flowers delight everyone. But though we are fortunate in being able to enjoy them, flowers do not exist for human pleasure. Most plants pass on life to future generations by means of seeds. It is the duty of the flower to make seed. All its beauty serves this one purpose. Color and perfume attract insects and hummingbirds to aid in the flower's pollination. Many peculiar shapes have developed to protect the chief seed-making parts, the tender stamens, pistil, and ovary, or to admit certain insects and no others. In the following pages, color photographs show some well-known American flowers. Their structure will be described and the work of each part will be explained.

Flower Communities

Plants live in groups because of their similar needs. Some grow in forests, others on the open prairies. The sides of streams and the mud bottoms of ponds also have their flower communities.

Flowers bloom in the Arctic, on high mountains, and even at the edges of glaciers. They cover the deserts in a riot of color after a heavy rain. Immense and gorgeous blooms grow in the tropics. The largest flower in the world is the rafflesia of Malaya. It measures up to three feet across and weighs about 15 pounds. The smallest is the duckweed, no larger than a tack head.

The greatest variety is found in the temperate zone, where nature is constantly changing her floral display. Here each flower blooms in its proper season according to the laws of its nature. In the spring appear those that need abundant water from winter snows and spring rains. Some that grow in the forests store up food in bulbs and rootstocks, so they do not need long hours of sunshine. They are small and low-growing, and appear before their taller neighbors can cut off their supply of sunlight.

Such flowers are the trillium, Dutchman's-breeches, spring beauty, and bloodroot (see *Bulbs, Tubers, and Rootstocks*). As the forest leaves open, shade-loving flowers appear under their cool protection. Most of the trees have finished their blooming season before the leaves expand. By midsummer the plants that live in drier soil and plenty of sunshine have blossomed—daisies, asters, sunflowers, and many others.

Many beautiful American wild flowers are becoming rare. When land is cleared for farms, homes, factories, roads, railroads, and golf courses, the woodland flowers disappear. Most people who live in large towns and cities now have to go long distances to find wild flowers in any number.

Everyone should make an effort to save those that remain. When we pick wild flowers we prevent them from forming seed and new flowers for the coming years. Some kinds of flowers have been wiped out by careless and thoughtless picking. Moreover, they give little pleasure, for they wilt almost immediately. Several states have laws that forbid taking certain rare species. But the real preservation of our native plants depends on the help of all who walk in fields and woods.

Rules for Picking Wild Flowers

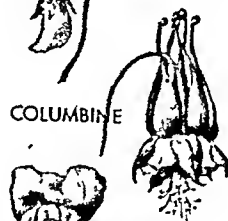
The Wild Flower Preservation Society, whose headquarters are in Washington, D. C., makes the following recommendations: Do not pick or dig up wild flowers in quantity unless they are abundant or weedy. Wild flowers that are not abundant should be picked or dug very sparingly, unless the land is to be cleared and the plants destroyed. Then efforts should be made to transplant as many as possible of the rarer ones to the same kind of conditions in a wild-flower preserve. Some species with bulbous roots, like trout lily, jack-in-the-pulpit, and spring beauty, will not bloom again if the leaves are picked with the flowers.

(Continued on page 181)

THREE PETAL FORMS



SWEET PEA



COLUMBINE



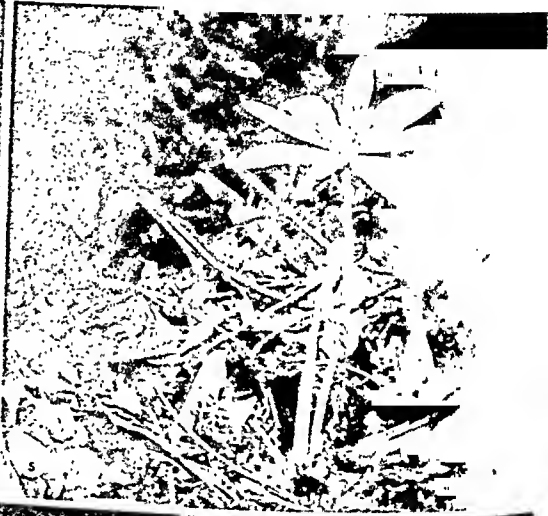
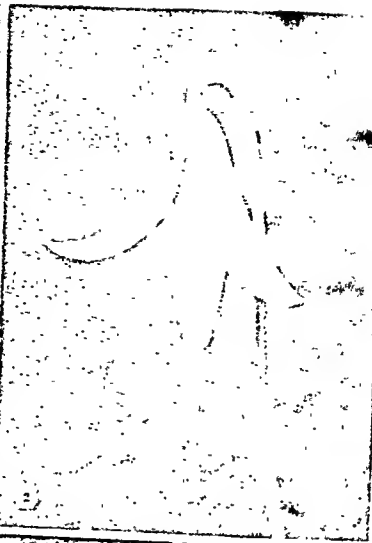
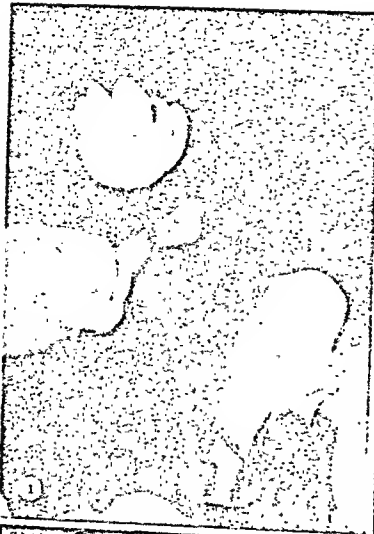
SNAPDRAGON

The corolla of the sweet pea resembles a butterfly. It is called a *papilionaceous* form. The columbine has hollow, spurred petals. The snapdragon is lip-shaped, or *labiate*.



WOODLAND HERALDS OF SPRING

- 1 May apple, or mandrake (*Podophyllum peltatum*) 2 Giant or white trillium, or wake-robin (*Trillium grandiflorum*)
 3 Trailing arbutus, also called the mayflower (*Erythronium repens*) (Arbutus life size, others about half size)



WOODLAND HERALDS OF SPRING

1. Twinleaf (*Jeffersonia diphylla*). 2. Adder's-tongue, or dogtooth violet (*Erythronium americanum*). 3. Wood anemone (*Anemone quinquefolia*). 4. Hepatica (*Hepatica triloba*). 5. Bloodroot (*Sanguinaria canadensis*). 6. Great Solomon's-seal (*Polygonatum commutatum*). 7. Purple trillium (*Trillium erectum*). 8. False Solomon's-seal (*Smilacina stellata*).



WOODLAND HERALDS OF SPRING

1 Jack-in-the-pulpit (Amorphophallus sp.) 2 Wild blue phlox or sweet wood aster (Phlox divaricata) 3 Wild columbine (Anemone fr. pulch.) 4 Flowering dogwood (Cornus florida) 5 Spring beauty (Claytonia virginica) (Flowers on the two pages are shown from half to one full size)



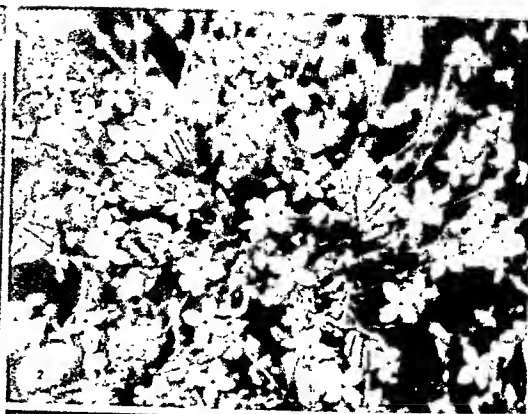
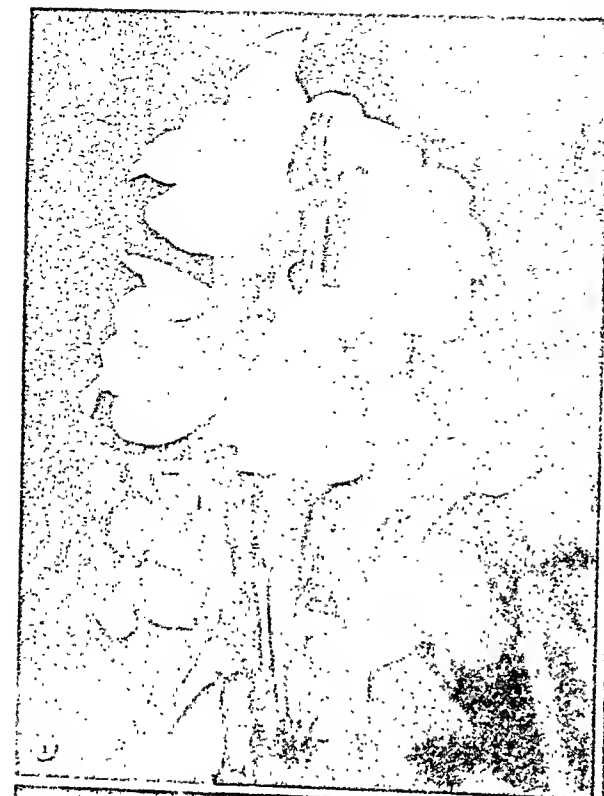
IN SUMMER FIELDS AND WOODLANDS

1. Turtlehead (*Cbelone lyoni*). 2. Cardinal flower (*Lobelia cardinalis*). 3. Blue-eyed grass (*Sisyrinchium angustifolium*). 4. Evening primrose (*Oenothera biennis*). 5. Wild geranium (*Geranium maculatum*). 6. Wild lupine (*Lupinus perennis*). 7. Cinquefoil (*Potentilla anserina*). 8. Wild strawberry (*Fragaria virginiana*). (Life size or slightly smaller.)



SCARLET GLORY IN A SUMMER GARDEN

The brilliant poppies provide a dramatic patch of color in the garden. These cultivated blossoms are a variety of the oriental poppy (*Papaver orientale*). They are shown somewhat larger than half size. Just as beautiful are the yellow California poppies and the little scarlet corn poppies which grow wild in European fields.



IN SUMMER FIELDS AND WOODLANDS

1. Butter-and-eggs, or yellow toadflax (*Linaria vulgaris*). 2. Bluebells, or innocence (*Houstonia carulea*). 3. Virginia cowslip, bluebell, or lungwort (*Mertensia virginica*). 4. Harebell, or bluebell of Scotland (*Campanula rotundifolia*). 5. Blue cardinal flower or great lobelia (*Lobelia siphilitica*). (Harebell half size; others about life size.)



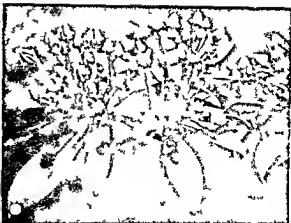
IN SUMMER FIELDS AND WOODLANDS

Woodily o wild orange edly (L. angustifolia) 2. F. cowed or great w. ow he b. Euphorbia
 angustifolia 3. Orange away hawkweed o de lisp n bush. Harac angustifolia 4. lod ang pa o
 brush (C. angustifolia) 5. W d o e (R. angustifolia) Pan bush one h d s ze o he s half s ze)



FLOWERS OF AUTUMN FIELDS

1. Goldenrod (*Solidago rugosa*). 2. New England aster (*Aster novae-angliae*). 3. Fringed gentian (*Gentiana crinita*).
4. Black-eyed Susan, or yellow daisy (*Rudbeckia hirta*). (All flowers on this page are about half life size.)



FLOWERING TREES AND SHRUBS

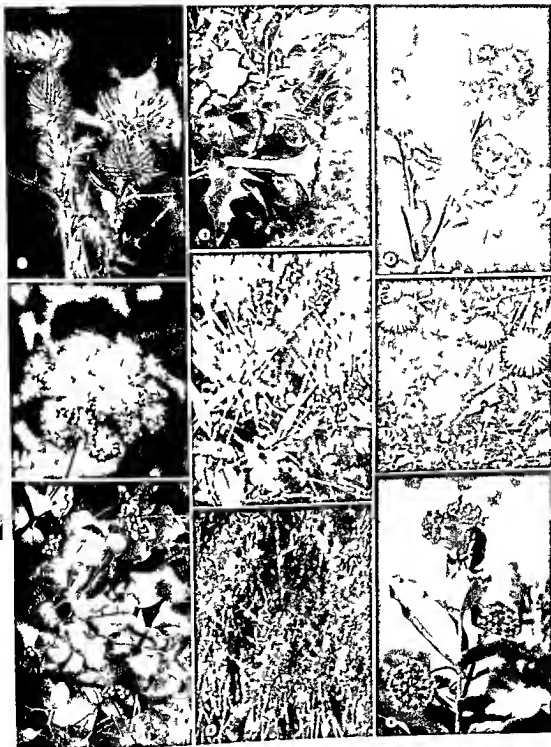
Flowering dogwood (*Cornus florida*) 2 Mountain laurel or a n h (*Kalmia latifolia*) 3 Japanese honeysuckle (*Lonicera japonica*) 4 Colorado rhododendron or California rosebay (*Rhododendron macrophyllum*) (Habitat: California)



LOVERS OF DAMP WOODS AND SWAMPS

1. Canada lily, nodding lily, or wild yellow lily (*Lilium canadense*).
2. Marsh blue violet (*Viola cucullata*).
3. Pink lady's-slipper, or moccasin flower (*Cypripedium acaule*).
4. American or sweet-scented water lily (*Nymphaea odorata*).
5. Broad-leaved or common arrowhead (*Sagittaria latifolia*).

(Half to quarter size.)



IMPORTANT FIELD AND GARDEN WEEDS

1 Blithes (C. am lance la um) 2 J moon weed (Du ara tranon um) 3 Bu dock (Aris aris m nae) 4 Queen Anne's
 5 Smartweed (F lygenum hydrop er) 6 Dandelion (Taraxacum offi nale)
 7 Poisonivy (To scodendron adiscan) 8 Heartw ngssore (Rumex has stula) 9 Common m lkweed (As lep a yriace)



IMPORTANT FIELD AND GARDEN WEEDS

- 1 Mustard, or charlock (*Brassica kaber*) 2 Locoweed (*Oxytropis splendens*) 3 Mullein (*Verbascum thapsus*) 4 Dwarf ragweed (*Ambrosia parviflora*) 5 Bindweed, or wild morning-glory (*Cerviculus sepium*) 6 Pokeweed (*Phytolacca americana*) 7 Curly dock (*Rumex crispus*) 8 Purslane (*Portulaca oleracea*) 9 Giant ragweed (*Ambrosia trifida*)

Other species may be picked in moderation if the roots are not disturbed and plenty of flowers are left to go to seed. Certain rare flowers should never be dug up or picked. The Society has lists of these various groups for different parts of the country. It will mail the lists to anyone who asks for them. The Society also publishes leaflets explaining how to start and maintain a wild flower preserve.

Making a Herbarium

It is interesting to make your own collection of pressed flowers called a *herbarium*. Pick all the plant down to the basal leaves. A tin carrying box called a *vasculum* keeps the specimens fresh and uncrushed until you get them home. If you do not own such a box, carry the plants between folds of newspapers.

When you are ready to press them, spread them out carefully between several thicknesses of newspapers or blotters and place a board on top. Weight the pile with books or rocks. Change the papers every day for three or four days. Leave the flowers in the press for about ten days. If they dry quickly and thoroughly they will keep their color. Mount them with scotch tape on heavy white ledger paper. The standard herbarium size is $11\frac{1}{2}$ by $16\frac{1}{2}$ inches. In the lower right-hand corner print the common and scientific names of the flower, the place where it was found and the date.

The Language of Flowers

Each kind of flower seems to have a personality which people have expressed as a language of flowers. In Western countries the rose is a symbol of love, the violet of modesty, the forget-me-not of faithful ness, the lily of purity, the rosemary of remembrance.

the pansy, of thoughtfulness, the primrose, of youth, the anemone of frailty, the hyacinth of sorrow.

The rose is the national emblem of England and Iran, the thistle of Scotland, and the chrysanthemum of Japan. In India the lotus has a sacred significance, as it had in ancient Egypt. In France the wild iris, conventionalized as the fleur-de-lis, was the

royal emblem. The United States has no national flower, but many states have chosen state flowers. (For lists of national and state flowers, see State Governments. National Flowers table in the Fact-Index.)

The Flower Industry

As wild plants grow increasingly rare, people satisfy their love of flowers by raising cultivated blossoms in their own gardens and buying cut and potted flowers from commercial growers. The flower and seed industries provide many thousands of workers with a living. About

90 per cent of the flowers are grown in greenhouses and 10 per cent in open fields. Greenhouses are located on the outskirts of cities, which are their chief markets. Illinois, New York, Ohio, New Jersey, and Pennsylvania have the largest investment in greenhouses. Roses are the most valuable flower (see Rose).

Amateur gardeners and greenhouses buy millions of dollars' worth of seeds and bulbs. California raises most of the nation's flower seeds in great farms on the Pacific coast. Flowers are also raised for their oils, from which perfumes are made (see Perfumes).

In nature the purpose of a flower is to make seed. On the next two pages are drawings which show clearly and simply how the lily makes seed. Then in the pages that follow seed making is explained in detail.

A DANDELION AND ITS FLOWERS



A dandelion blossom is really a bouquet of many tiny flowers, attached to a base called the receptacle. Such a flower is a composite. At the left is a dandelion head in bloom; center, single flower; and right, a head gone to seed.

THE DIFFERENT KINDS OF FLOWER CLUSTERS



QUEEN ANNE'S LACE

MULLEIN

LILY OF THE VALLEY

SWEET WILLIAM

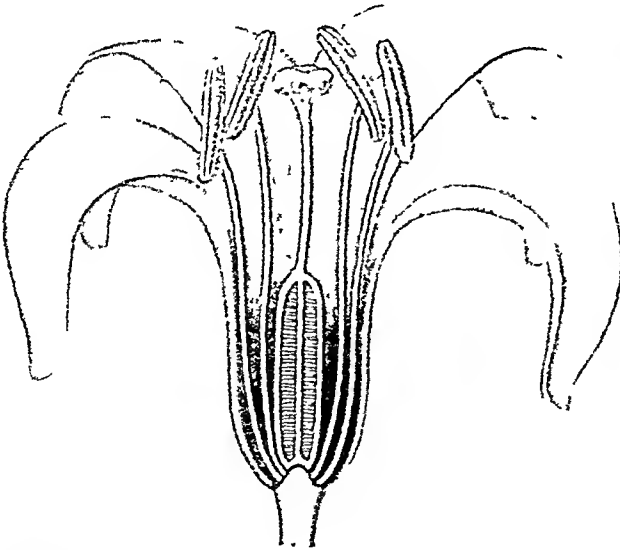
GOLDENROD

The arrangement of the flower heads on the stem is called the inflorescence of the flower. Queen Anne's lace is an example of a cyme or umbrellal shaped cluster. The top of the main stem branches into many small stems called pedicels, all of equal length and ending in a flower. Mullein grows in a spike equal length and ending in a flower. The flowers are situated by their base directly to the main stem. The lily of the valley is a raceme. From the main stem grow pedicels, each ending in a flower, but the main stem itself is not topped by a flower. In a cyme like sweet William, both main stem and pedicels end in flowers. Some of the goldenrods form pyramidal shaped pedicels. Each pedicel on the main stem branches into many smaller pedicels, each ending in a flower.

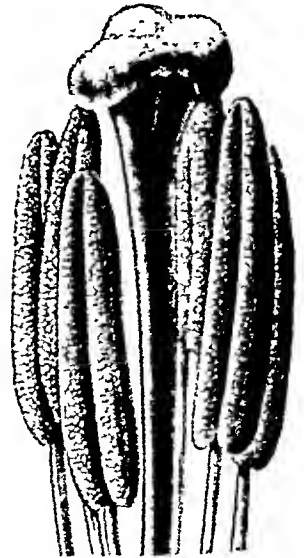
THE STORY OF NEW LIFE AS TOLD BY THE LILY

Here is a Bermuda, or Easter, lily. Where did it come from? It grew from a seed, but where did the seed come from? The story of how flowers make seed is a part of the story of life itself.

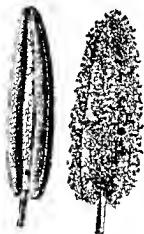
The following illustrations show a Bermuda lily cut open, and its parts as seen through a magnifying glass and a microscope. The pictures show that seeds are made by stamens and pistils. The stamens, which are the male parts of the flower, make pollen. The pistils, with their ovaries and eggs (ovules), are the female parts. Insects usually carry the pollen from the stamen of one plant to the pistil of another. A new flower starts when a male cell from the pollen unites with a female cell in an ovule, and a seed begins to develop.



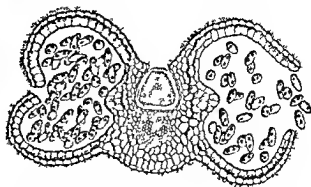
This drawing shows the lily cut open down one side. The complete parts are in groups of three or six—three sepals, three petals, six stamens, and an ovary in three parts. Cutting the flower lost two stamens, a sepal, and a petal. In the center is the pistil. Around it are four stamens, a sepal, and a anthers on top. Around these parts are white-colored sepals and petals.



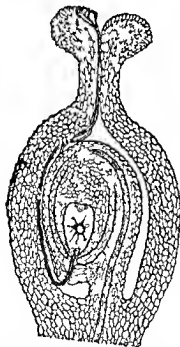
Here is a closeup of the anthers and the pistil. Notice how the top of the pistil swells into three knobs. The lily pistil actually consists of three parts, called carpels, joined together.



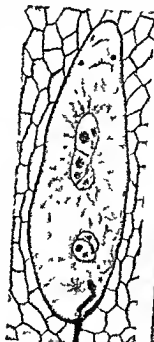
Anthers produce pollen grains. Here are two anthers, greatly enlarged. The one at the left still has the pollen grains inside. At the right the pollen has ripened and the grains have burst free from the anther.



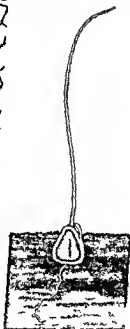
This picture shows how the pollen escapes. An anther has been sliced crosswise and we are looking down into it through a microscope. On each side is a pollen sac with grains. The sac at the left is still closed. The sac at the right has split open to let the ripe pollen flow. Now the grains are ready to be carried to a pistil by some insect seeking nectar.



Here is a pistil cut open lengthwise and shown under a microscope. It is vase shaped and has a sticky part called the stigma at the top. The stigma has caught a grain of pollen from the anther. The grain has sent a tube down through the neck of the pistil (called the style) into the base or ovary and then upward into the center mass called the ovule.



At last a new life starts. A pollen tube has entered an ovule through a tiny opening (the micropyle) and the male cell carried by the tube from the pollen grain joins the female cell. Now the egg is fertilized and will become a seed.



Thanks to the process of reproduction shown in the preceding pictures the seed can start a new plant. Here a seed has taken root in the soil and sent out its first shoot and root. In this way the parent plant is able to carry on the race.

How Flowers Do Their Work of Making Seed

WE CAN enjoy a flower's beauty and perfection of form more fully if we understand its structure and how each part helps in the work of seed making.

A typical flower has four sets of organs. From the outside to the center, they are: *sepals*, *petals*, *stamens*, and *pistils*. We may see these parts in the drawing. The leaflike sepals make up the *calyx*, or "cup." The petals form the *corolla*, or "little crown." Calyx and corolla together form the *perianth*. When present, the *bract* is a small leaf below the flower.

The flower rises from the *axil* of the bract, that is, the angle between the bract and the stem. Bracts are sometimes the most conspicuous feature of a flower and may be mistaken for petals. This is true of dogwood, poinsettia, and Indian paintbrush. Sometimes one great bract forms a hood, called a *spathe*, as in jack-in-the-pulpit, the calla lily, and the skunk cabbage. The top of the stem, to which the parts are attached, is the *receptacle*.

The parts of a flower are attached to the receptacle or base in three different ways. If they are attached at the base of the ovary, the flower is *hypogynous*, meaning "growing on the lower side of the ovary."

The tiger lily is an example. In the second form the receptacle is cup-shaped and encloses the ovary. The sepals, petals, and stamens are attached to the rim, surrounding but free from the pistil. The flower is said to be *perigynous*, meaning "around the ovary." The cherry blossom is perigynous. In a third type the ovary grows fast to the receptacle, and the parts grow from its top. The flower is *epigynous*, meaning "growing upon the ovary." An example is the apple blossom.

Sepals and Petals

The sepals are the lower, or outermost, part of the flower. They fold over the tender, closed bud and protect it from cold and other injuries while it is developing. Usually sepals are green. In many flowers, however, they are as colorful as the petals and increase the flower's attractiveness to insects. Tulips, irises, and the yellow pond lily, or spatter-dock are examples. Sometimes the sepals grow together, as in the carnation, forming a vase-shaped calyx.

The petals attract insects and hummingbirds to help in the work of pollination. By their fragrance and color they advertise their sweets—the nectar in the

heart of the flower. This is the reward the flower offers its helpers. Glands at the base of the petals secrete nectar. Oil in the petals gives the flower its perfume (see *Perfumes*).

Many flowers have petals of the same size and shape arranged in a circle around the center. They are said to be *regular*. The wild rose is typical. The petals of the morning-glory and petunia are joined, forming a funnel-shaped corolla. Each portion is regular in shape but the petals are united. Such flowers are said to be *sympetalous*.

The illustrations at the beginning of this article show several common types of *irregular* flowers. These flowers have parts that vary in shape. The honeysuckle and cardinal flower have irregular blooms.

Many irregular flowers are pollinated only by a certain kind of insect. The snapdragon can be sprung open only by the heavy bumblebee (for picture, see *Bee*).

The simplest flowers have no sepals or petals at all. The small flowers of grasses consist commonly of three stamens surrounding a single pistil (see *Grasses*). They are said to be *naked*. Some flowers are *apetalous*; they have no petals.

Stamens and Pistils

Inside the ring of petals are the *stamens*. Their number varies greatly in different flowers. Each stamen has a stem called the *filament*. At the top of the filament

is the *anther*. The pollen grains form in the sacs, usually two in number, inside the anther.

Finally, inside the ring of stamens is the *pistil*. It is shaped like a vase, with a neck and oval base. The neck is known as the *style*. On top of the style is a *stigma*, which has a sticky surface. Its purpose is to catch and hold the pollen. The base of the pistil is the seedcase known as the *ovary*. Inside the ovary are one or more eggs, the *ovules*, which become the embryo plant. Some flowers, for example the lotus, buttercup, and strawberry, have many pistils. The pistils may be separate from one another or they may be closely united. A simple pistil, or one of the segments of a compound pistil, is called a *carpel*.

When ripe pollen from an anther of the same kind of flower catches on the stigma, each pollen grain sends out a tiny threadlike tube. The tube grows down through the style and pierces one of the ovules within the ovary. This process is called *fertilization*. Each



PARTS OF A FLOWER

Above we see the principal parts of the flower: (1) bract, or leaflet; (2) pedicel, or secondary stem; (3) sepal; (4) petal; (5) pistil; (6) anther; (7) stamens.

ovule must receive the contents of the pollen tube before it can develop into a seed. It usually takes the tube from two to five days to reach the ovule. The time may vary, however, from only a few hours to six months.

How Pollination Takes Place

We have just seen that a seed cannot grow until pollen is transferred from the stamen to the pistil. This transfer is called *pollination*. Since flowers cannot go after pollen, they depend on some carrier to bring it to them. Most of the well known flowers are pollinated by insects chiefly by flies, moths, wasps, bees, and sometimes by the hummingbird. The flowers attract these helpers, as explained earlier in the article, by their color, fragrance, and nectar. Some flowers open in the evening and invite the night-flying insects to their banquet table. They are nearly all ways white or pale yellow, the colors which show best at dusk.

To reach the nectar, insects must crawl over the pistils and anthers into the heart of the flower. Their bodies become covered with pollen dust. As they move from flower to flower, they transfer the pollen of one to the stigma of another. Flowers which require the help of insects are called *entomophilous*, meaning "insect-loving." Some flowers are so formed that they can be pollinated only by a single kind of insect, for example, the fig, yucca and red clover (see Clover, Figs, Yucca).

Certain flowers depend on the wind to bring pollen to them. They are called *anemophilous* or "wind-loving." Most common trees, the grasses, sedges, plantains, and many others depend on wind pollination. Wind pollinated flowers are the simplest type. They usually have no sepals or petals, for the wind has no need for nectar and fragrance. They are dull in color. They produce enormous quantities of pollen. The wind is wasteful and scatters pollen indiscriminately, so that only a small percentage falls on the stigma of the same kind of flower.

A few kinds of flowers are self pollinating, that is, they can be fertilized with their own pollen. In most cases however nature takes great care to prevent self pollination. A more vigorous plant results from cross pollination—the transfer of pollen from one plant to the stigma of another plant of the same species.

Flowers avoid self pollination in several ways. In some cases the stamens and pistils mature at different times. In other flowers the stamens are shorter than

the pistils and hence do not deposit pollen on their own stigma. Wind pollinated flowers usually bear the stamens and pistils in separate flowers. Alders, birches, walnuts and hickories bear catkins with pistillate flowers on some branches, and catkins with staminate flowers on other branches. Corn has the pistils and stamens on different parts of the same plant (see Corn). The tassel bears the staminate flowers, the ear bears the pistillate

flowers. These are known as *monoecious* ('of the same household') plants. A few plants like cotton, woods and willows, carry the separation even farther with the staminate flowers on one tree and the pistillate on another. These are known as *dioecious* ('of two households') plants.

Some flowers are tiny but grow in showy clusters. In the largest family of flowering plants, called *Compositae*, tiny florets are set so close together in a solid bead on a receptacle that we mistake them for a single flower. A dandelion is a composite of many florets. In other composite flowers, like the daisy and sunflower, perfect seed producing flowers are found only in the center. The rim is made up of 'ray' flowers (for picture see Sunflower). Garden flowers in this group are the aster, zinnia, dahlia, chrysanthemum, and marigold. The family includes many weeds, among them ragweeds, thistles, and burdock.

The Origin of Flowers

At least 150,000 species of flowering plants are known to botanists. All these varied forms descended

from a primitive ancestor which no longer exists. The most primitive of modern flowers are the members of the buttercup order, *Ranales*. Only a step higher in the scale of development is the rose order, *Rosales*. The simplest flowers are the least skillful in making seed. A large number of stamens means a great deal of pol-

FLOWERS OF THE BEECH TREE



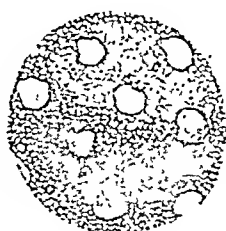
Many tree flowers have stamens and pistils, but no sepals or petals.

ATTACHMENT OF FLOWER PARTS

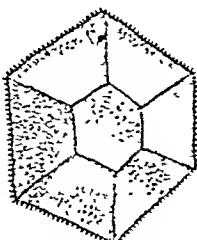


The parts of a flower are attached to the base, or receptacle, in three different ways in relation to the ovary. In these pictures the ovary is the bulb-shaped form at the base of the pistil. 1 The parts of an *hypogynous* flower grow on the lower side of the ovary. 2 The parts of a *perigynous* flower grow around the ovary. 3 In an *epigynous* flower the parts grow upon the top of the ovary.

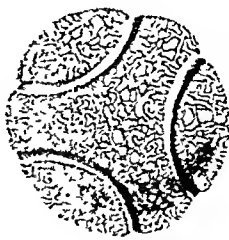
POLLEN GRAINS UNDER THE MICROSCOPE



PHLOX



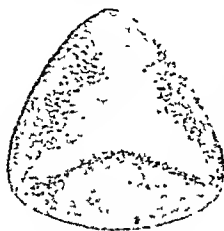
DANDELION



PASSION FLOWER



RHODODENDRON



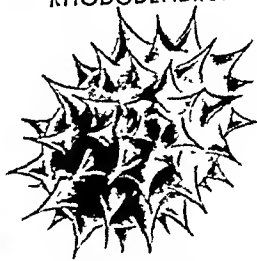
NASTURTIUM



TIGER LILY



WILLOW HERB



MARGUERITE

The pollen grain of each flower has a shape quite different from the pollen of any other flower. Some botanists believe that the distinctive shape explains why the grain can adhere to and pollinate the stigma of its own kind of flower and no other.

len is wasted. A large number of pistils means that many will fail to become pollinated and produce seed. All members of the buttercup order, which includes the little buttercup itself and the splendid magnolia and water lilies, and all the roses have many pistils and stamens. The aristocrats of flowers, those that are the most highly specialized and most successful in reproducing themselves, are the Composites.

How Fruits Develop

After fertilization of the ovule has taken place the petals, sepals, stamens, and usually the upper part of the pistil fall off. Now, as the ovules grow into seeds (embryo plants), the ovary, or seed case, also changes. In some plants it turns into a fleshy covering. The ovary wall separates into two layers. The inner layer becomes a hard shell, called a stone or pit, which encloses the seed. The outer layer forms the pulpy portion of the fruit. The peach, plum, cherry, and apricot are examples of such fruits.

In the case of berries, the entire ovary becomes a fleshy mass in which the seeds are embedded. In the apple, pear, and quince, the ovary and its seeds become the core of the fruit. The pulpy part which we eat is the modified calyx.

The ovaries of many plants develop into so-called dry fruits—capsules, pods, nuts, and acorns. Like the fruits and berries, they protect the seeds and help to scatter them when they are mature (see *Nature Study; Seeds*). Another kind of dry fruit is the *achene* (also spelled *akene*). In this case the ovary wall becomes a coating of the single seed. It does not open at maturity, as the pods and capsules do, to release the seed. Achenes are developed by flowers which produce but one ovule, such as the individual flowers of the Composites. The style of the pistil sometimes

remains attached to the achene as a long, feathery tail which carries the seed away on the wind (see the illustration of the dandelion in this article).

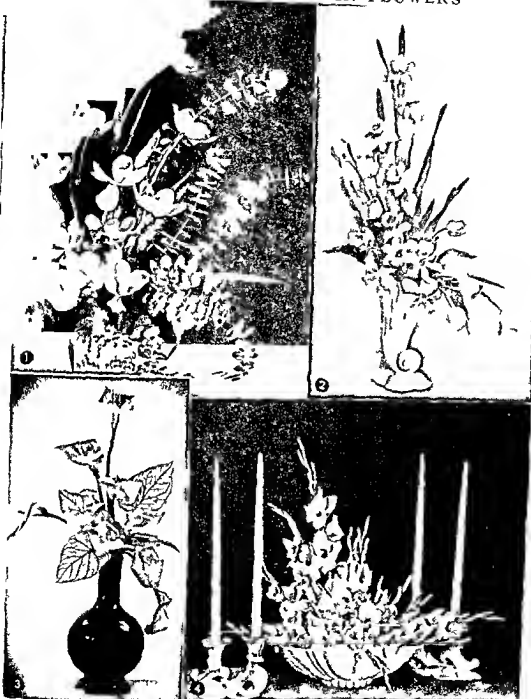
Two Kinds of Flowering Plants

Flowering plants belong to the phylum called *spermatophyta*, or seed producers (see also *Botany Reference-Outline*, section "Classification of the Plants"). Throughout this article we have been describing the flowers and seed-making of one group of this phylum, the *angiosperms*. These are flowers which enclose their seeds in an ovary. Another group of flowering plants, called *gymnosperms*, has naked, or exposed, seeds. These plants include the conifers, or cone-bearing trees, such as the pine, fir, spruce, cypress, and cedar. The cycads, tropical plants resembling palms or tree ferns, and the ginkgo are also gymnosperms (see *Trees*). Cones take the place of flowers.

Cones are of two kinds, staminate and pistillate. They are usually borne on different branches of the same tree. The staminate, pollen-producing cones are small and last only a few weeks in the spring of the year. The pistillate cones are the large familiar ones. The ovules, usually two in number, are located on the upper surface of each scale. The ovule consists of an embryo sac surrounded by a covering which later becomes the seed coat. In the covering is a tiny opening called the *micropyle* (little gate).

In late spring the pistillate cones stand upright with the scales opened wide to catch the wind-blown pollen. When pollen lodges between the scales they close. Thus protected within the closed cone, the pollen sends out a pollen tube which enters the ovule through the micropyle. When the seeds in the cone are fully grown, it again opens, releasing the matured seed. All gymnosperms are wind-pollinated.

DISPLAYING BEAUTY IN FLOWERS



These arrangements made by the Bright School of Floral Design illustrate basic principles. 1 The decorative value of foliage appears in the group where tulips are arched to emphasize the graceful curves of eucaalyptus sprigs. 2 White tulips and jonquille combine in triangle design to dominate the upswEEP of the vase. 3 To display the full beauty of large flowers use only a few and combine them with bald simple foliage as in this group of callas and caladium. 4 Sleeder sprays reach out from the bowl to extend the focal point (base) of this mass use of gladiolus in a low centerpiece.

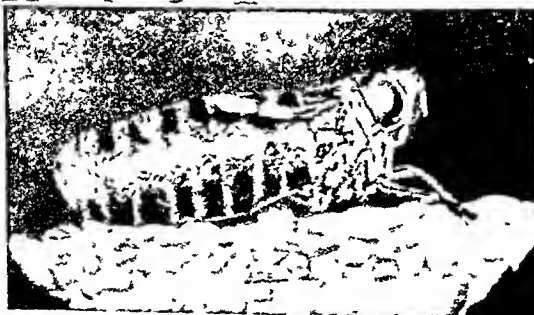
THE START OF A DANGEROUS CAREER



Here we see the growth of a fly, shown in pictures much larger than life size. At the top is a tiny larva, its mouth is at the pointed end. Next is a pupa case; a newly matured adult has just eaten its way out at one end. In the third picture the fly crawls free. Lastly it rests and dries its wings before starting upon its active adult life.



FLY. There was a time when men thought that houseflies were just a harmless nuisance. Not until the 20th century did they find out that these flies carry disease germs to food, and thereby cause millions of deaths a year. Far from being harmless, the fly proved to be one of man's deadliest enemies.



Look at a fly through a magnifying glass. You will see that its claws, padded feet, and body are covered with bristling hairs, and its tongue is coated with sticky glue. Samples of the dust and dirt clinging there may, under a powerful microscope, reveal bacteria of such diseases as typhoid fever, tuberculosis, or dysentery. Flies get these germs from garbage and sewage. If they touch our food later, it too may become infected.

We cannot avoid this menace by just "swatting flies." They can multiply faster than we can kill them. It has been computed that between April and September one female fly could have more than $5\frac{1}{2}$ billion descendants if all her female offspring lived and their descendants lived. Of course, this does not happen; but plenty of flies will be produced every summer if only one female in a hundred escapes death long enough to lay eggs. The only good way to suppress flies is to prevent breeding.

How Rapid Breeding Starts in the Spring

Prolonged exposure to freezing weather kills flies, and in cold climates only a few fertile females lying torpid in sheltered places survive the winter. Warm weather reawakens them and they seek moist spots such as manure piles or garbage in which to lay their eggs.

The eggs look like tiny white grains of wheat, about $1/20$ th of an inch long. The female will lay 150 or more in several clusters, and within 24 hours the eggs hatch into white larvae or maggots. These feed and grow for about five days, then become pupae. Some five days later an adult fly emerges; and within two weeks more, each new female is ready to lay eggs.

The Right Way to Suppress Flies

Once flies are established in a locality, they can be suppressed only by eliminating the places in which their eggs can hatch and the maggots can feed. If manure and garbage could be removed and destroyed twice a week, there would be no houseflies. Usually this is impractical. But garbage can be kept in fly-proof containers of sheet metal or screening while awaiting collection. Manure piles can be treated with suitable chemicals; for example, a half pound of fresh hellbore dissolved in ten gallons of water for each eight bushels of manure. Even better, because it adds fertilizing value to the manure, is a mixture of half a pound of calcium cyanamide and half a pound of calcium superphosphate (acid phosphate) to each

bushel. The mixture is put on dry, then water is added.

Where flies are held to a minimum by such measures, householders can protect themselves from the survivors or strays with screens, sticky fly paper, fly poison, and by swatting. To swat a fly successfully, one should aim one-half inch behind it.



The construction of its legs compels it to jump backward as it "takes off" to fly away.

Bodily Features of the Housefly

Because of its tiny size and weight the housefly can find enough food almost anywhere. The adult is about one quarter of an inch long and about half an inch across the outspread wings; and a thousand adults weigh less than an ounce. Each foot on its three pairs of legs is equipped with claws and two hairy pads called pulvilli. These pads secrete a sticky liquid, which enables the fly to cling to virtually any surface. It can run upside down along a ceiling or on the under side of a glass skylight.

To help it in finding food and dodging danger it has five eyes. Two of these are huge compound structures and cover most of the head. (For picture, see Eye.) Between these are three tiny simple eyes set in a triangle. The sense of vision, however, is not sharp, the fly relies more upon its acute sense of smell.

The mouth parts are adapted for sucking up liquid food. A long "tongue" which is really a proboscis like an elephant's trunk, has two pads or lobes at the end, which act as funnels for drawing in liquid. The fly can also reduce soluble foods such as sugar to liquid by spreading saliva on them.

Houseflies have no equipment for biting. The popular belief that they bite before a storm arises from their close resemblance to sand flies or stable flies (*Stomoxys calcitrans*). Storms often drive these bloodsucking pests into dwellings where they are mistaken for houseflies.

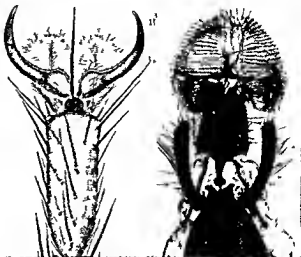
Other Members of the Fly Tribe

Most two winged insects (*Diptera*) are properly called flies. In place of the second pair of wings possessed by bees, dragonflies and many other insects, the true flies have club-shaped balancers (*halteres*). About 45,000 members of the order *Diptera* are known, of which about 11,000 are found in North America.

Next to the housefly (*Musca domestica*), the most widespread and annoying members of the tribe are probably those "little flies," the mosquitoes. Some of these rank also among the deadly disease carriers (see Mosquito). Another dangerous biter is the tsetse fly of central Africa (see Tsetse Fly).

Much damage is done by fruit flies in tropical and semitropical countries, particularly Hawaiian. Especially harmful is the Mediterranean fruit fly

THE FOOT AND TONGUE OF THE FLY



These pictures taken with a microscope show why the fly is highly dangerous to man. At the left is a fly's foot. Two sharp claws help it to cling to rough objects. Under them are sticky pads which are adored to smooth surfaces. At the right is a device called "tongue." It dips into food, and sucks up nourishment through the channels on the under surface. All of these parts pick up disease germs and spread them.

(*Ceratita capitata*). With the sharp end of her body the female punctures the skin of fruits and deposits from one to six eggs. When the maggots hatch they eat into the pulp and cause decay.

The fruit fly called *Drosophila melanogaster* has proved, however, extremely useful in studies of heredity. It passes through its life cycle in a few days, breeds prolifically, and responds readily to experiments. The results of selective breeding, of diet, and of other influences through numerous generations can be observed within a short time.

Flesh flies lay their eggs and breed in stored meats, bottles or feed flies torment cattle, sheep, and horses, and gall goats damage fruit. Other annoying or vicious flies are the tiny midges, including the "punkies" or "no-see-ums" (*Ceratopogon pitipennis*) of the northern woods, the swarming black flies (*Simulium hirtipes*), which have been known to drive animals into fatal frenzies, horseflies, which also bite men, and the so-called bee lice, bat ticks, and sheep ticks, which live as parasites and hence have lost their wings.

More useful members of the order are the syrphus flies, which resemble bumblebees and wasps and destroy plant lice, drone flies, whose larvae live in foul water eating decaying vegetable matter, and robber flies, which consume other insects with murderous greed. Less-known members of the group are the louse flies, the numble flies, the hump-backed flies the March flies, and the false crane flies.

Flies are among the oldest of insects. Their fossil remains are found in rocks of early geologic ages, and also preserved in amber. (See Amber.)

THE FLY IS READY FOR ACTIVE LIFE



Here the newly emerged fly, shown even more enlarged than on the opposite page, has dried its wings and is ready for its first buzzing flight. That buzzing will be caused by the swift beating of those wings, which are capable of 130 strokes a second. Barring accidents the fly will live from one to four months.

CONTRASTS AMONG THE MEMBERS OF THE FLYCATCHER FAMILY



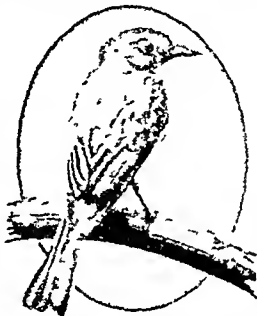
The beauty of the group is the crested flycatcher, at the left, with its bright yellow-brown back and yellow belly. The king-

birds, at the right, are aggressive little fighters, with a particular dislike for crows and hawks, which they delight in chasing

FLYCATCHER. From an exposed lookout on telephone wire, fence post, or dead and leafless treetop, the flycatchers watch for their insect prey. Suddenly they dash out, twisting and turning in the air with amazing speed, snap up the luckless insect with a sharp click of the bill, then circle back to resume their watch. Again they may be seen ferociously attacking a crow or hawk several times their own size, returning to the perch after the big intruder has been routed.

The true flycatchers (family *Tyrannidae*) are a numerous group found only in the Western Hemisphere. There are nearly 400 species, most of them in the tropics; only 30 nest in the United States. Their voices are short and harsh, with the exception of the wood pewee's whose plaintive three-note call is exquisitely sweet. The Old World flycatchers (family *Muscicapidae*) are all good singers.

Flycatchers are large-headed birds. The bills are wide at the base, with long bristles. The plumage is generally gray or olive above and white or gray below. Notable exceptions are the dazzling vermilion flycatcher (for picture in color, see *Birds*) and the lovely black, white, and salmon-colored scissor-tailed flycatcher, both of the Southwestern states. The latter has a tail ten inches long which it opens and closes like a pair of scissors whenever it is excited. It is the state bird of Oklahoma. The kingbird is easily observed from its favorite perch on telephone wires along country roads. It is about eight inches long, with slate-colored back and wings, white breast,



The phoebe is a friendly little bird which prefers to nest near human neighbors.



The pewee is the only songbird of the family. Its sweet, sad notes sound through the summer woods.

and black tail broadly tipped with white. The black crown has a partly concealed patch of orange red

The pewee is a shy forest bird, about six and a half inches long, modestly dressed in dark olive green and gray, with two white wing bars. The very similar phoebe is somewhat larger and lacks the wing bars. The phoebe's favorite nesting place is under a bridge or bank. The crested flycatcher, about nine inches long, is the largest of the family, with prominent crest, yellowish-brown back, and canary yellow underparts. It has the curious habit of weaving a piece of cast snake skin into its nest. The olive-sided flycatcher has a dark breast with white line down the center

Four small flycatchers (five and a half to six inches long) are difficult to distinguish in the field and are best identified by their distinctive calls and the nature of their habitats. The least flycatcher, or chebec, prefers the trees of orchard and lawn. The alder flycatcher nests in alder thickets, the yellow-bellied flycatcher in evergreen forests, and the acadian flycatcher in low woodlands near streams

These birds range from the Atlantic coast to the Rockies. On the Pacific coast are subspecies. They migrate in winter to South America.

The scientific name of the kingbird is *Tyrannus tyrannus*; vermilion flycatcher, *Pyrocephalus rubinus*; scissor-tailed flycatcher, *Muscivora forficata*; crested flycatcher, *Myiarchus crinitus*; phoebe, *Sayornis phoebe*; pewee, *Myiochanes virens*; olive-sided flycatcher, *Nuttallornis mesoleucus*.

FLYING FISH A fish out of water is not always the helpless flopping creature which has given us the common expression for the awkward bungler. Indeed few things are more beautiful than the sight so frequent in warm seas of a company of silvery fish rising suddenly out of the waves under the steamer's bow and darting through the air like huge dragonflies.

Flying fish do not wave their fins in flying as birds flap their wings. They gather speed under water and swoop up into the air. High speed photographs show that sharp blows of the tail on the water's surface with a sculling motion give added power to the take-off. Then the air catches under the broad fins and the fish soar like glider planes. The smaller species of the Atlantic Ocean cover short distances only out of the water but the larger species found off California from Point Conception southward often travel 200 yards. Their fins are eight or nine inches long and the body may be 18 inches long. It is deep blue on the back and sides and is silvery underneath. Some 65 species of flying fish are known.

All flying fish use their power of flight to escape from their numerous enemies. Chief among

**A FLYING FISH
SOARS THROUGH
THE AIR**



Here the high speed camera shows how flying fish travel through the air. The upper one is soaring at the top of its flight, the bottom one is just taking off, and the ripples of the tail that gave the fish take-off speed have left foamy traces on the water.

these are sharks and tuna fish. They sometimes fall on the decks of ships in their frantic efforts to get away. Most varieties are excellent food.

Scientific name of common flying fish *Eucetopterus* volitans of California species *Cypselurus californicus* FOCK (fish) MARSHAL FERDINAND (1851-1929)

Outflanked on the right outflanked on the left Situation on the whole excellent. Am going to advance. This according to tradition was General Foch's message to the French commander in chief General Joffre at the gravest crisis in the battle of the Marne in September 1914. And advance he did thereby contributing greatly to the success of the battle that saved Paris from German occupation (see World War First). Less than four years later he led all the Allied armies to victory in the war.

General Foch was the son of a lawyer in the south of France. At the age of 20 he was admitted to the Ecole Polytechnique the highest school for training officers in France and his record there led to his appointment in 1894 as a lecturer in the French War

College. There he won instant recognition for his genius in strategy and his ability to inspire others with his own unconquerable spirit. Before many years he was made commander of the college.

Although 63 years old when war broke out in 1914 he held high command from the start. In 1917 he was made chief of staff of the French army. Then in March 1918 a German breakthrough threatened to win the war and all the Allies realized that a supreme command was needed to avert catastrophe. Almost automatically the Allies turned to Foch naming him coordinator of the armies on March 29 and supreme commander on April 14.

Using his new authority he checked the first German onrush then withstood other assaults and gathered reserves until in July he was ready to counter attack. On July 18 he opened a whirlwind drive which did not stop until the Germans asked for an armistice. Meanwhile on August 7 he had been made a marshal of France. After the war he served in advisory capacities until he died on March 20 1929.

FOG. A sea captain stands on the bridge of his ship and can see nothing but a gray cloud all around him. He listens anxiously for the sound of bells or horns to guide him into the harbor. An airplane pilot circles an airfield for hours, unable to land. These men and their craft are halted by *fog*—the one element in nature that still baffles man.

When fog shrouds an area, it envelops everything in a gray or yellow vapor. The United States Weather Bureau calls a fog that obscures objects at a thousand feet or less, a *dense fog*; other fogs are *light*. Unless radar aids are available, in a dense fog ships and aircraft must move very cautiously or not at all (see Radar). Some airfields maintain systems for burning away fog, but they are costly to operate.

How Air Moisture Produces Fog

Fog, like dew and clouds, comes from the moisture in the air. The moisture condenses and gathers around microscopic bits of dust to form fog particles. Each particle is less than 1/25,000th of an inch in diameter. In dense sea fog there may be 20,000 of these particles in one cubic inch. Even far out at sea there are enough bits of dust in the air for fog formation.

But the fog cannot form until the air is made to give up its moisture. The moisture leaves the air and condenses when the air is cooled by some means, for cooler air cannot hold as much water as warmer air. Fog starts to form when the air is cooled below its *dew* or *saturation* point—that is, below the temperature at which the air is completely saturated and can hold no more water.

Another necessary condition for fog formation is a gentle air current to mix cool air into warmer air. This is the ordinary means of bringing the warmer air to below the dew-point temperature. In still air, only dew forms, because the cooling takes place near the ground (see Dew). With rapidly rising air currents, the cooling takes place high above the ground and

only clouds are formed (see Clouds). Thus whether dew, clouds, or fog is formed depends on the presence or absence of air currents.

Fogs on Land and Sea

Over land, fogs usually form just after sunset, although they may persist well into the next day. An evening fog begins when the sky is clear. As the sun goes down, the earth radiates heat into the clear sky, and the air above the ground becomes cool as well. As the temperature drops below the dew point, fog is formed. Heat from the sun the next morning, aided by stronger morning winds, usually dissipates the fog.

Because the earth cools by radiating heat into space, these fogs are called *radiation* fogs. Another type of fog is called an *advection* fog. This forms when a mass of warm air passes over a cold land or a cold sea. The great fogs over the sea off Newfoundland are advection fogs, caused by the passing of warm air from over the Gulf stream northward over the icy waters of the Labrador current. Advection currents also form over land when a warm air mass from the south passes over a snow-covered area to the north. Another type of advection fog forms when cold air passes over warm water. These are the fogs that rise from ponds and lakes during early morning in the autumn.

A third type of fog is called an *upslope* fog. This occurs when an air mass passes over an area of gradually increasing elevation. As the elevation increases, the atmospheric pressure decreases, and the air expands. The expanding air loses heat, and fog is formed. An upslope fog often forms when a moist easterly wind blows up from the Great Plains across the Rocky Mountains.

Smog—the Problem of Cities

The mixture of fog and smoke over large cities is called *smog*. Fog over a city is usually more intense than over the surrounding countryside, because the city discharges a greater amount of moisture into the atmosphere. This, combined with dust and the heavy chimney smoke from manufacturing plants, makes a thick vapor that does not disperse easily unless the wind is strong.

Smog abatement is a problem in large cities because the smog carries dirt and droplets of sulphuric acid that settle everywhere. One answer lies in chimney traps that filter the smoke before it rises into the atmosphere. Another is educating industrialists and managers of large buildings to bring about more efficient operation of furnaces. This not only reduces smog; it also prevents the loss of unburned fuel that escapes when a fire smokes.

DISPERSING FOG BY FIRE



To abate the menace of a fog-shrouded runway, some airports can now burn atomized gasoline or oil to disperse the fog. Left, we see how the fuel burns in a line along the runway. Right, the operator in a central station controls the burning by push button.

The DANCE of the PEOPLE—FOLK DANCING



These pictures show a typical Danish folk dance, The Crested Hen. The step used throughout the dances is a skip done by stepping on the left foot, keeping on the left foot, then stepping on the right foot and hopping on the right foot. The dancers stamp on the first note of the music and then skip vigorously around in a circle, jumping every so often in such a way as to come down with a stamp on both feet. Then they weave in and out under an arch formed by their partners' arms.

FOLK DANCE Young people of the United States or Canada doing square dances for the sheer fun of dancing are doing folk dances. So are young people of Mexico doing their traditional dances before an audience of tourists in Mexico City. Yet if the people of these nations had always lived as they do today they probably would not have any folk dances. The same thing is true of the people in most other countries.

The reason is that folk dancing develops in a simple, rural type of society. It appeared during the Middle Ages in Great Britain and Europe as serfs became peasants, with land of their own and a community life separate from that of the court and manor house. It developed during the colonial period in Mexico and South America. The people then usually lived all their lives in one community. They did not have any of the mechanical means of amusement—motion pictures, television, radio, and phonographs—which provide entertainment today. They did not travel much. Hardly anyone could read. But every one could dance. So the people danced whenever an occasion offered—at harvest festivals, at vil-

lage fairs and fetes, at weddings and at family and community social gatherings of all kinds.

Usually they danced in groups rather than in couples. Old and young often took part together. The steps were simple, universal ones: walking, running, skipping, sliding, turning, jumping, and whirling. Some of the dances were hardly more than marches. Others developed into elaborate arrangements of steps.

Almost all were gay and lively for the people were dancing to enjoy themselves.

Pagan Rites in Folk Dances

These peasants and villagers were living in a Christian society, but they had a heritage of pagan religious and ritual dances. The meaning of the ritual had long been forgotten. The dances themselves, or parts of them, had somehow come down through the generations. People incorporated them into dances they now did "for fun."

The sword dance, oldest of English folk dances, is an example. A group of young men carrying ribbon-decked rapiers performed this dance. They moved in a circle weaving in and out around each other, at the same time carrying out intricate maneuvers with the swords. Presently

DANCING THE SWEDISH 'TANTOLI



In this dance, the couples first do several polka steps forward. Then they dance around with lively jig steps each boy's hands on his partner's waist and hers on his shoulders. Then she jumps and he lifts her into the air.

WINE-GLASS DANCE FROM A BASQUE SPECTACLE



The four men shown here are leading dancers of the 'Mascarades', in which 25 to 80 men take part. From left to right they represent a sweeper who sweeps the ground before the horseman, a standard bearer, a horseman, and a "woman" shopkeeper. As a climax, the horseman mounts the wine glass on one foot and then springs from it into the air without spilling the wine.

they crossed and interlaced their rapiers in such a way that the swords formed a frame called a "lock" or "nut." One of the dancers held this high in the air while the others circled gaily around it. Then he lowered it over the head of a kneeling dancer. The other dancers closed in, each seizing his own rapier and suddenly releasing the "lock." The kneeling

MORRIS DANCE IN THE DAY OF ELIZABETH I



These pictures are from early prints showing the English morris dance. This was an exhibition dance performed in the period following Whitsunday. Authorities believe that it developed from the spring fertility rites of pagan times and possibly from a modification of the English sword dance. The dancers wore bells on their legs and carried sticks or knotted handkerchiefs. The small figure shows William Kemp (right), a comedian in Shakespeare's company at the Globe Theater, who wagered that he could morris dance from London to Norwich. He took six weeks for his "dance marathon," and was feted all along the route.

dancer fell over as though he had been beheaded. In some versions the dance ended with a mock funeral. In others, the "beheaded" dancer revived and went on with the dance. Historians believe that this dance made use of an ancient ritual in which a victim was actually sacrificed, the purpose being to make the earth fertile.

Dances around the maypole are also believed to have had a pagan source. They are thought to embody remnants of a tree-worshipping ceremony which was part of spring fertility rites. In the ancient ceremony the dancers circled about a living tree garlanded with spring flowers to symbolize fertility. During the course of the ceremony each dancer moved forward to touch the tree and so identify himself with plant life.

Courtship in Folk Dancing

Many folk dances had a simpler symbolism, which was understood by the dancers themselves. This was the symbolism of courtship. The girls pretended to be reluctant while the boys wooed them. In many courtship dances the boys interrupted their wooing to perform difficult, athletic steps in competition with one another. Eventually the girls showed that they "accepted" their partners. Then in some of the dances, the boys spun them around and lifted them high in the air time and time again. This type of dance in more sophisticated form appears often in present-day ballet.

The courtship dances of Mexico and South America as a rule were more restrained than some of the European dances. One of the most popular of all Mexican dances 'El Jarabe Tapatio' (the hat dance) is a courtship dance. Originally it probably had a pagan significance. In this dance the boy flings his sombrero at the girl's feet to show that he has proposed. The girl steps onto the brim and dances around it with quick, birdlike steps. She holds her skirt out as she dances and bends lower and lower. Finally



she dances off the hat brim and puts the hat on her head. This indicates that she has said "Yes." The dance ends with the boy and girl dancing together faster and faster, with his *sarape* (a large, brightly-colored scarf) thrown around them.

Historians of the dance see in the movements of 'El Jarabe' an imitation of the wooing of doves. They trace its origin to primitive times, when people imitated the movements of fowls and other animals in their dancing. Some authorities say that the dance imitates the wooing of sacred birds, thus giving it a pagan religious source.

National Characteristics in Folk Dancing

The people handed their dances down from generation to generation through many centuries. The dances came to reflect the temperament and environment of the people. The sword, morris and country dances of England in their modern form are gay but dignified. They require precision, agility and endurance. Nimble footwork is conspicuous in Ireland's reel, jig and hornpipe. In the jig and hornpipe the heels and toes tap out a "music of the shoes." Vigorous kicking and beating steps characterize the Highland fling, sword dance, reel, and schottische of Scotland, and the dances require very little space.

The Cossack dance of Russia is alternately wild and dignified. The polonaise of Poland is stately, but Poland's rustic dances are lively, with much jumping and stamping. The tarantella of Italy is temperamental, with quick changes of mood. The jingling of tambourines emphasizes its tempo. The bolero fandango, and seguidilla of Spain are spirited and picturesque. The schuhplatteln of Bavaria is exciting as the dancers mark the tempo of the music by clapping their hands and slapping their thighs.

The czardas, a Hungarian tavern dance, is alternately furious and languorous and is done with careless grace. The cold climate of the Scandinavian

A PRIMITIVE DANCE HIGH IN THE ANDES



This is a harvest dance of the Aymara Indians of Bolivia. Such dances are on the borderline between ritual dances and folk dances. The folk dances are actually done for recreation, though they may have evolved from rituals.

countries influenced the dances of the people. The men dance vigorously and jump freely. The women, hampered by long woolen skirts, stress pantomime and whirling. (For definitions of the dances mentioned, see each dance by name in the Fact-Index.)

Folk Dances of the United States

Folk dancing developed in the United States during frontier days. The dances have inherited features, chiefly English, Irish, and Scottish. Many of the tunes are Irish or Scottish jigs or reels. The dances, however, bear an unmistakable American stamp. They are of four general types, as follows:

Square dances, with four couples in square formation, begin with an introduction such as circling, right and left, allemande left, grand right and left, and promenade home. A figure is then called. Each

PICTURESQUE DANCES OF OUR MEXICAN NEIGHBORS



At the left is the 'Danza de los Arcoes' of Oaxaca in Mexico. The 'arcoes' are made of many colored flowers. The picture at the right shows the 'Jarabe' dance in Yucatan, where the people are famous for their cleanliness and their snow white clothes. The dance is named for the jarabe, a stringed instrument similar to a guitar. With drums, conchas, and gourds it accompanies the dance. The Jarabe is a step dance, that is, the rhythmic pattern created by brushing, stamping and tapping the feet against the floor is a feature of the dance. These pictures are from paintings by the Mexican artist, V. de la Cruz.

couple in turn dances this around the set. The dance ends with a finale similar to the introduction. Among the most widely known square dances are 'Darling Nellie Gray', 'Life on the Ocean Wave', 'Texas Star', 'Dive for the Oyster, Dig for the Clam', and 'Swing That Girl Behind You'.

In *New England longways dances*, any number of couples form two facing lines. The odd-numbered couples progress down the set, dancing in turn with the even-numbered couples below them. The best-known dances are 'Lady of the Lake', 'Boston Fancy', 'Portland Fancy', 'Hull's Victory', and 'The Circle'.

Southern mountain dances are done by any number of couples side by side in a circle. In a mountain cabin this usually means six to eight couples. There is an introduction, as in square dances. Then the odd couples progress around the set, dancing a called figure with the even couples, until the caller summons them back into "the same old circle" for a finale like the introduction. Favorite figures include 'Shoot the Owl', 'Trail the Lady', 'Twistification', 'Box the Gnats', 'Ladies Doe', and 'Grapevine Swing'.

Play-party games originated as a substitute for dancing in rural sections where religious sects banned dancing. Any number of boys and girls take part, singing to furnish their music. In theory, these are games, not dances, because of the absence of musical instruments. Some of the most familiar play-party games are 'Skip to Ma Lou', 'Hold My Mule While I Jump Josie', 'Way Down in the Paw Paw Patch', and 'Shoot the Buffalo'.

Dying-out and Revival of Folk Dances

Group dancing for recreation becomes less important in people's lives when villages grow into towns. Many people become prosperous and seek more sophisticated amusement than the lively, often boisterous country dancing. Poorer people do not have much

time for their traditional dancing, and fetes and festivals may disappear. The advent of industrialization, with its big cities and mechanized civilization, completes the suppression of the people's dances.

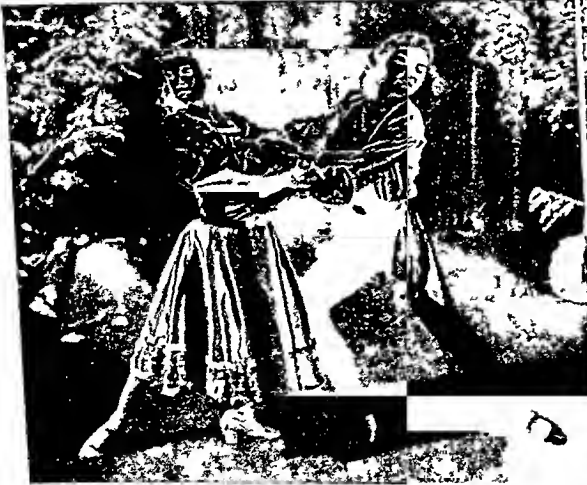
These changes had taken place in the United States and most European countries by the end of the 19th century. Folk dancing lingered as a natural form of expression only in isolated regions.

Movements for the revival and preservation of folk dances sprang up in various countries. Sweden established the Friends of Swedish Folk Dancing in 1893. Similar societies were soon organized in other countries. The American Folk Dance Society was founded in 1916, with headquarters in New York City.

Today many published collections of folk dances are available. Folk dancing is a part of the physical education curriculum in schools and colleges. National and international festivals of folk dance have been held in many countries. Museums in the United States conduct programs of folk dances from other countries as part of their regular educational and social activities. Square dancing has become a popular form of social amusement.

In addition, folk dances live through ballet. The leaps of the male dancer which win such great applause—the *entrechat* and the *cabriole*—developed from the jumps of the peasants. The classical *pas de deux*, in which a couple dance alternately together and separately, is a highly refined courtship dance. Many individual ballets have folk dance themes. 'Three Cornered Hat' is based on a Spanish fable and glorifies the steps of Spanish folk dances. In 'Coppélia', boys and girls dance the czardas on the village green. Cossack dances appear time and time again in typical Russian ballets. The ballet sequences of the popular musical comedy 'Oklahoma' are elaborations of American folk dances. (See also Ballet; Dance.)

FOLK DANCES AT A CHRISTMAS FESTIVAL



The Museum of Science and Industry in Chicago celebrates Christmas with a series of festivals known as "Christmas Around the World." On these occasions Chicago people revive the customs, dances, and songs of their ancestral lands. At the left, two girls do a graceful, stylized ballet version of a Czech folk dance. At the right, a little girl of Scotch descent does the Highland fling while her mother accompanies her on the bagpipes.

AMERICAN FOLKLORE *and Its OLD-WORLD BACKGROUNDS*

Most of our present day folk tales have come down from past generations. How the songs and stories came to be is part of the fascinating history of folklore, as told in this article. The illustrations are by James Daugherty.

FOLKLORE People have always liked to tell stories and to sing songs. Even in the days before there were books to be published and bought, people made up tales and tunes with words to them. And their friends listened and sometimes tried to learn them by heart so that they could go away and give them to others to enjoy. As people repeated them they often changed these tales and songs so that they would sound a little better to the new hearers. And the new hearers went away looking for friends to hear them, and they in turn tried to make them better.

After they had been changed many times the first singer or teller had been forgotten and it could not be truly said that any of the stories and songs had come out of the mind of any one person. Nearly all the people who were the folk (Americans are likely to say 'folks') of the neighborhood from which the stories came had contributed a part. These tales, songs, and sayings were known as the lore of the folk or more often as folklore.

The folk have a real joy in making up tales, painting pictures, carving statues from the ideas that they and their neighbors in the country, village, or town have had. It is as natural for them to do so as it is for bubbles to rise in the pure water of a mountain spring. Perhaps their grandfathers and grandmothers have given them these ideas and these old people perhaps got them as children from their fathers and mothers.

Some of the world's best lullabies have come to us that way, changing a little as different fathers and mothers have sung them to their children at different times in the many years of the world's history. Some good bedtime stories began in the same way. Sometimes instead of singing or telling an idea, a man or woman or child has painted it or carved it in wood or stone, usually without taking any lessons in how to do it. That is how folk pictures have been made, pictures that do not show the skill of a good artist but do tell a story or look like a person everybody in the neighborhood knows.

The men who worked at building the big European churches known as cathedrals made fun of neighbors whom they did not like, such as the village miser, the scolding wife, and the cruel schoolmaster. Though they had not studied sculpture, the builders carved ugly likenesses of these people and placed them high up on towers and roofs. Sometimes they carved in the stone their village's idea of an evil spirit or an ugly devil. And now, hundreds of years later, they still look down on us, telling us what people of long ago thought and imagined. We call these grotesque carvings gargoyles. They are all part of what people now know as "folk art."

How Ballads Came to Be

Often in the far past things happened that people found so exciting that they wanted to tell others about

them. There were no ways then of printing in books, magazines, or newspapers the news of what had happened, and so men made songs which told it in verse and sang them. These story songs they called ballads, and many of them are sung even to this day, both in Europe and in America. The ballads tell of old battles, old and usually unhappy loves, of wicked crimes that took place when the world was younger than it is now.

In the very early days of England and other European countries there were singers who were appointed by the kings to make up songs of praise about the wars they fought, about the celebrations that followed when they had been won, about the wonderful gifts the rulers gave to the faithful warriors who fought for them. These men they called scops, and many of the people heard them sing the history of their time and learned the words. Sometimes these people changed the words to suit their wishes and sang the new versions to each other.

But people of those days in the old countries of Europe liked quite as well, if not better, the tales that were not true history but were made up from dreams and fancies and superstitions. These tales grew up through many years until men began to gather them

together and print them so that anybody who could read could enjoy them.

The Brothers Grimm

Among the people who gathered these stories were two brothers, Jakob and Wilhelm Grimm, who lived in Germany and began their work at the beginning of the 19th century. They worked for years getting the stories together before they published them in books called 'Nursery and Household Tales' (see Grimm).

When scholars studied these tales, many of which had been told the brothers by the wife of a cowherd, they found that the stories were very like those that had long been told in other countries. Some had been told in the days before Christ and in different countries and different languages. The story of Cinderella had been told in Iceland more than a thousand years ago, and men had told stories like it in Bohemia, England, France, Russia, and other countries.

Folklore Comes to America

When people from all these nations began to come to America they brought with them the tales and songs they had heard as children. Soon in the towns and cities of America, Swiss and Swede, Hungarian and Irish, Dutch and Turk, Finn and Dane were living side by side and telling each other the folklore of the coun-

tries from which they came. Some groups of people from across the seas stayed together in America and kept alive the ways and customs of the old countries.

That is why, to this day, in the bayou region of the state of Louisiana the Acadians, people of France who sailed first to Canada and were later exiled to the region near the mouth of the great Mississippi River, sing songs that were once sung in the French provinces in the early part of the 18th century.

That is why, in both North and South Dakota, people whose grandfathers came from Sweden and Norway and Denmark still dance to jigs that once sounded gaily over the fields of far-away Scandinavia. That is why people whose fami-



Centuries ago in many European countries people told stories about a fierce dragon who raged over the countryside, leaving terror and woe in its wake. The stories always ended happily, however, because a young and mighty hero would appear and slay the dragon after a pitched battle.

les came many years ago from the highlands of Scotland still sing in the Great Smoky Mountains of North Carolina where those families have lived ever since they arrived such ballads as Barbara Ellen and Lord Randal. These songs began so far back in Scotland's dim past that no historian or antiquary knows exactly when they were first sung or whether what they tell is true or made up from the fancies of the people.

Folk Tales Americanized

Since folklore goes usually from one person to another by word of mouth and not by the printed page it changes as it goes. So Americans have often left out of old songs and stories those words and those lines which deal with things which they do not recognize. Because the Americans who sang it have never seen a Scottish nobleman the ballad of Lord Randal has been changed to simple Johnnie Randal. And Johnnie when they sing it is no longer in the mind of a richly dressed young lord but just a lanky mountain boy whom they might meet on the way to town almost any day.

In just such manner the nightingale of an Italian song may become a meadowlark or mock ingbird when the song is made over to fit the language and the experience of the Americans who sing it. The line "Sweet William came from the Western States" appearing in an old English ballad may mean to the mind of the

American singer that Sweet William was born west of the Mississippi River. He is likely to think of him therefore as a cowboy in chaps, checked shirt and sombrero. Actually at the time the song was written in England such a costume had never been heard of.

Frequently and especially in folk tales Americans have made use of events that were related in the folklore of Europe but have told them as having happened in places in the United States. More than one German folk tale for example has been about a man who

slept for many years. Washington Irving who knew these tales wrote a similar one. It was not about a great red bearded emperor like one of the German stories. It told of Rip van Winkle, a kindly lazy Dutchman who lived in a small village on the banks of the Hudson River.

He went out one day with dog and gun into the Catskill Mountains and did not return until after he had taken a nap that lasted 20 years. In the same way Irving made use of German folk tales about ghostly riders of phantom steeds. He moved steed and rider from the banks of the Rhine to the banks of the Hudson in his tale of a headless horseman who haunted Sleepy Hollow.

More amusing than that have been the efforts of some Americans to make the folklore they know seem even more American than it is. In the first part of the 19th century an American Dr. Samuel Latham Mitchill rejoiced that Americans had driven out the forces of the English king and were now ruled not by kings but by the wishes of the people. He felt that kings should not be mentioned even in folklore. He found one of the verses of Mother Goose folklore that all American children have loved very bad indeed. So he changed it and instead of reading

When the pe was open
The birds began to sing
Wasn't that a pretty dish
To set before the king?

he made it read

When the pe was open
The birds were songless
Wasn't that a pretty dish
To set before the Congress?

Nobody paid much attention to the change however and we still sing the Mother Goose verse on.

In this manner Americans have accepted the songs and tales of other nations filled them with American scenery and American characters and made them seem as American as if they had been born in one of the United States. But America already had a folklore when its first settlers arrived and a new folklore grew up out of America after their arrival. A folklore that did not come from Europe but was purely and com-



The old stories went on to tell how the young hero married the beautiful princess. Fresh from his combat he would kiss and see her hand as reward for his valor.

pletely American. It sprang from the native soil and from people who made the land their own.

American Indian Folklore

The folklore that was here already when the white man came was, of course, that of the American Indian. It held tales about animals, witches, little people,

good spirits, and ugly spirits. In many ways it was connected with the religion of the Indians and there is no sharp dividing line between their religious myths and their folk tales. Indian folklore also held many songs and dances that were part of their festivals and usually had a religious meaning.

The Indian had a real feeling of thanks to the Great Spirit for his blessings, and this feeling of thanks was a part of his life. If he killed a buffalo for meat, he thanked the spirit of the buffalo for the use of the meat. He was grateful to the maple trees for the sweet water which they poured out to him in the spring of the year and from which he could make maple syrup. He thanked the green corn for its sweet ears. He thanked the spirits who had planted the juicy red strawberries for his enjoyment. He sang and danced his thankfulness and often told stories of how the good things and the bad things of life came to be. Many American Indians tell these stories even now, wherever American Indians come together. They tell of the old woman who lives on top of a high mountain. After the old moon has reached its fullness, she cuts it up into little stars and she strews them all across the heavens.

Sometimes at night in the darkness of Long House where the Indians of the Six Nations, the Iroquois, hold their religious rites, they beat upon drums and dance for their friends—the Little People—who join them only when they cannot be seen. People who have studied Indian folklore are surprised that many of the tales are almost the same as those told by American Negroes captured in Africa by slave traders and sold in America as slaves. Perhaps folk tales go back so far through the years that they come from a time when all peoples understood each other and told stories that were remembered. No one knows why the same stories are to be found in the folklore of peo-



Because the American Indians had no written language, they kept their stories alive by retelling them around the council fire. Through these tales they expressed thanks to the Great Spirit and recounted the brave deeds of the tribal warriors.

ples who do not speak the same language and live in parts of the world that are far, far apart.

Americans Develop Their Own Folklore

As for the folk tales that were born in America and are therefore completely and especially its own they began to grow early in the country's history and grew naturally from its landscape and work. When the first settlers came to America they found jobs to be done that were so hard that doing them seemed impossible. The idea of doing the impossible has always appealed to the American sense of humor. From the days of Benjamin Franklin to those of Walt Disney, Americans have amused themselves by picturing ridiculously impossible doings as if doing them were a matter of course.

Benjamin Franklin was once sent by the government to London to give the English a better idea of the new nation known as the United States of America. He was so amused by the writings of English travelers who came to America for a stay of a few weeks and then went back home to write books about this exciting land, that he made fun of them in a letter that he wrote to a London newspaper.

In his note he complained that the English writers had not mentioned the fact that the American sheep grew so much wool on their tails that they could not carry its weight without help. Each one, he said, now dragged a little cart along behind him to hold his tail up. He also scolded that there had been no report in England of the fishing for cod in the Great Lakes on the Canadian border of the United States. He said that of course everyone knew the cod to be a salt-water fish and the water of the lakes to be fresh. But, he said it was a known scientific fact that fish will swim into any kind of water when they are pursued and the hungry whales of the Atlantic were chasing the codfish up the American rivers into the Great Lakes. 'But let them know sir,' he wrote 'that the grand leap of a whale in that chase up the falls of Niagara is esteemed, by all who have seen it, as one of the finest spectacles in nature.' One can easily imagine today a Disney cartoon showing sheep dragging carts bearing their wool loaded tails or the cod's frantic jump up Niagara Falls just ahead of the open jaws of the hungry whale.

Paul Bunyan and Tony Beaver

One of the first big jobs about which Americans began to make up amusing stories was that of cutting down the trees. They had to clear land on which to

build houses and to plant corn and wheat and other crops. They built log cabins from the felled trees and after the crops had been gathered made rafts and flatboats and keelboats from them too in order to float the grain down the rivers to market.

Lumbering became one of the most important businesses and one of the hardest. Axmen who came to be known as "lumberjacks" might work all day in the far spread woods and feel at sundown that they had done almost nothing toward clearing the land. It was natural then that they should go back to their lumber camp have their supper, and afterward each take his turn on what they called the "demon's seat"

(really the storyteller's chair) to dream up the greatest lumberjack of them all, Paul Bunyan, for whom no task was too difficult. It was Paul who could fell two great trees at once as his ax swung forward to deliver one blow and backward to deliver another. When it got too hot he had to cool it in a near-by spring that to this day is known as a boiling spring. After he had walked west from Maine, where some say he was born, it was Paul's footsteps that filled with water to make the Great Lakes. The tales of Paul and his big blue ox Babe, who measured 42 ax handles and a plug of Star Chewing Tobacco from tip to tip of his magnificent horns, are so many that they fill about a dozen



Benjamin Franklin, the wise statesman and inventor, was also a wonderful storyteller. His description of a whale leaping up Niagara Falls in pursuit of a codfish is one of the great American tall tales.

books. Most of these books have all sorts of pictures that show different artists' ideas of what the two of them looked like.

But Paul is not the only great lumberjack of our folklore. Even while Paul was growing up, another big fellow who could do big things was being made into a folk giant by the fanciful minds of the folks who lived in the wooded mountain sections of West Virginia. Tony Beaver was his name and some said he was a cousin of Paul's. At any rate he looked and acted much like Paul Bunyan but Tony lived south of his supposed cousin.

When the lumberjacks of the American woods tired of telling stories about Paul Bunyan or Tony Beaver, they made up songs about their own jobs. There are many of these, some of them named for the part of the country they were working in—like 'Blue Mountain Lake'—or the kind of work they were doing—like 'The Shanty man's Life'. Lumberjacks still sing these songs as they work at cutting down trees and floating the logs on the rivers down to the sawmill where they will be cut into boards or crushed into

pulp to make paper. Here is the first verse of 'The Shanty-man's Life':

Oh, a shanty-man's life is a wearisome life, although
some think it void of care
Swinging an ax from morning til night in the midst
of the forests so drear
Lying in the shanty bleak and cold while the cold
stormy wintry winds blow,
And as soon as the daylight doth appear, to the
wild woods we must go.

Other lumberjack songs tell of
the work in the woods in a more
lighthearted vein.

Mike Fink,
the Great Jumper

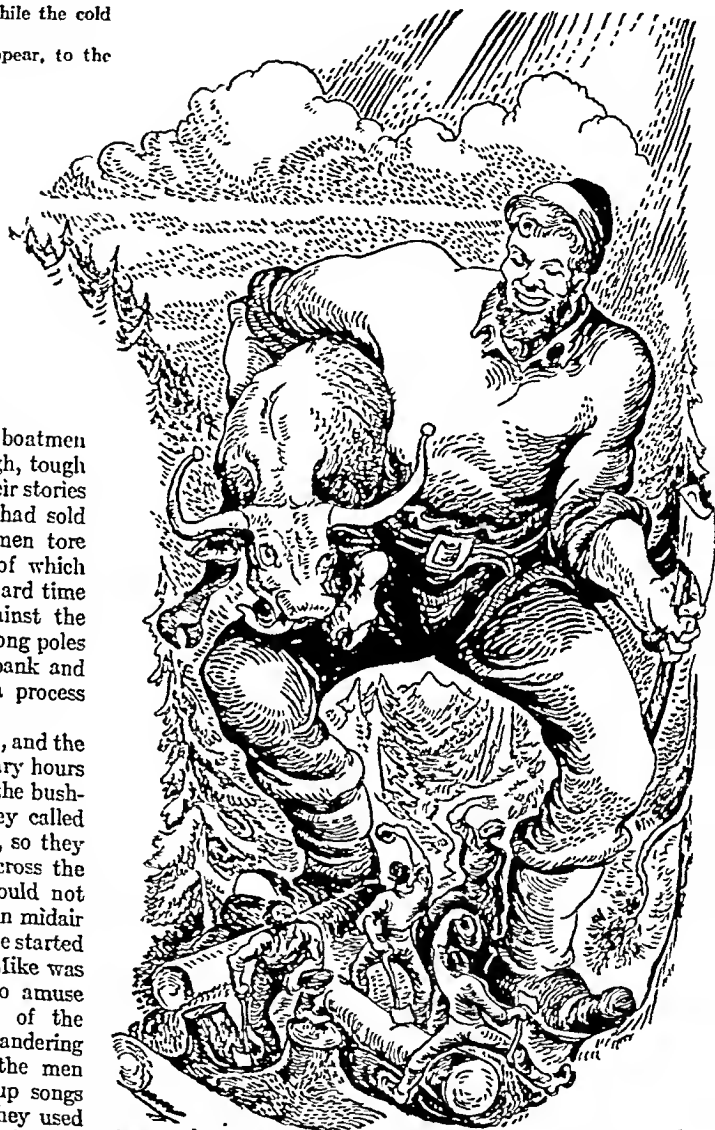
Logs were not the only cargo floated down river in the early days before steamboats were invented, however. Men grew wheat and corn and oats and barley. They made log rafts and flatboats and keelboats and loaded them with the grain harvest and sent them along the current to the big cities below. The raftsmen and the boatmen who worked on the river were a rough, tough roaring group of men and they had their stories of heroes too. Sometimes after they had sold their grain at the market the raftsmen tore their rafts apart and sold the logs of which they were made. The boatmen had a hard time bringing their boats back home against the current. They would push with their long poles and they would grab bushes on the bank and thus pull themselves along upriver, a process they called "bushwhacking."

The journey home was long and hard, and the men who made it whiled away the weary hours making up tales about the king of all the bushwhackers and keelboatmen whom they called Mike Fink. Mike was a great jumper, so they said, and once had almost jumped across the Mississippi. But when he saw he would not quite get there he had whirled about in midair and managed to get back to the shore he started from without falling into the water. Mike was a great shot, they said, and used to amuse himself by shooting the kinks out of the tails of little pigs that he saw wandering along the river banks. Sometimes the men who told Mike Fink stories made up songs instead. One of the best ones that they used to sing along the Ohio and Mississippi rivers had a refrain that went like this:

Hard upon the beach oar
She moves too slow
All the way to Shawnee Town
Long time ago.

While the western river valleys were echoing with the loud boasts of the rafters and boatmen, the east coast also had its folk characters. The whalers of New England and the men who crowded sail on the swift commercial vessels—the racing clippers of the

China trade during their long days and nights at sea—were making up tales of the Old Stormalong and his mighty ship the *Courser*. She was so big, they said, that the sailors had to ride their watches on fleet



Giant Paul Bunyan, king of lumberjacks, is the hero of stories told wherever woodsmen gather. Babe, his big blue ox (who matched Paul in size) was his companion on many adventures.

horses to see that the whole deck was orderly. And they spoke of Capt. Ezekiel Macy Sims, who trained a swordfish to catch breakfast for him by sticking his sword right through a nice fat sea bass or bluefish and bringing him home like a doughnut on a stick.

Chanteys and Other Work Songs

The sailors who manned the great clippers learned something in those days that many Americans who

work with their hands have found out—that work goes easier when it is done by men working together in rhythm and that the simplest way to set the rhythm is by singing a song. The sailors hauling lustily as the big sails rose made up and sang work songs which they called chanteys and they all pulled together at the moment set by the beat of the song. Of the songs they made up three of the best were Way Rio, Santa Anna and The Banks of the Sacramento. Way Rio starts like this

O say were you ever a R o Grande?
Way you Rio!
It's there that the river runs golden sand
For we're bound to the R o Grande

Chorus

And away you R o Way you R o
Sing fare you well my pretty young girl
For we're bound to the R o Grande

Some of the most exciting of the work songs came from the thousands of Negroes who did a great deal of the heavy work on the plantations on the steamboats that plied the southern rivers and on the railroads in early days. They sang songs each with a different rhythm to fit the movements of the body as they did their work. There were songs for hoeing cotton (cotton chopping they called it) and songs for picking cotton, songs for driving steel spikes along the bed of the railroad and songs for hoisting heavy bags of grain to the decks of the steamboats.

The most famous of all these work songs was the ballad about John Henry the great Negro railroad construction worker who wagered that he could drive a steel spike in to solid rock as fast as a newly invented steel-driving machine could do it. Using only his twelve pound sledge he won the race and the wager but died from trying so hard. Some say he really died of a broken heart.

Negro workers in the deep South still swing their long handled sledge hammers to the rhythms of this work song and sing out the story of John

Henry the steel-driving man. As the Negroes sing the ballad John Henry seems like a very real person who might reappear at any moment with his sledgehammer. Here are two verses of the song.

Captain said to big old John Henry
That old drill keeps a-coming a-coming
Take that steam drill out and start on that job
Let it whop let it whop that steel on down
Let it whop let it whop that steel on down

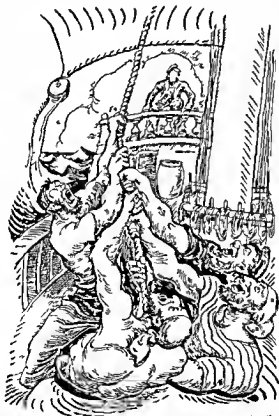
John Henry told his captain
That a man he ain't nothin' but a man
And before I'd let your steam drill beat me down
I would drive a whammy hammer in my hand
I would drive a whammy hammer in my hand

Negro Folklore

Among the most beautiful American songs are the folk hymns of American Negroes—hymns that we call spirituals. From the days of slavery when Negroes first were converted to the gentle teachings of Jesus Christ they have expressed in their songs of religion all the grief of exile from the African home and their labor without pay in a new land. These Christian folk hymns are sad with minor melodies and their words are beautiful poetry which has no one author but was put

together by thousands of people who told of their woes and of the comfort that faith in Jesus gave them. Such songs as *Swing Low Sweet Chariot*, *Sometimes I Feel Like a Motherless Child*, *Look Down Look Down that Lonesome Road*, *I Couldn't Hear Nobody Pray* have given all Americans who love music a feeling of pride in the musical gifts of the nation's Negro citizens.

The Negro folk tales have none of the sorrow that characterizes their religious songs. They are gay tales of the doings of humans who talk and play tricks on each other. American children of all ages and colors have loved them ever since Joel Chandler Harris collected them from his Negro friends and then created old Uncle Remus to tell them over again. The stories of Brer Rabbit and Brer Fox, Brer Bear and Sis



Men who pull heavy loads have always known that singing makes the work lighter. Secenta made up many rhythmic chanteys to sing as they hoisted up. The long awayes, he said in many sets when they gave them the goal to pull together.

Cow are still among the funniest and wisest of folk tales. There are other animal stories that are like them in many countries of the world but nowhere have they been better told than by Harris.

Pecos Bill and the Cowboys

The Negro cotton pickers sang words to tunes that fitted the rhythm of their picking. The sailors on the clipper ships sang rhythms that made hauling on the mainsheet easy. And in the Far West, where the grassy plains feed millions of cattle, the American cowboys have made songs that go along to the swing of the hooves of galloping horses. The plains, Americans discovered, were vast, natural pastures. When the great herds of bison had been killed, often needlessly by hunters who did not need food, the ranchers put big herds of cattle in their place. The cowboys watched over them in feeding season, then drove them in thundering thousands to market. Keeping the herd quiet, particularly at night when the howl of a coyote or the cry of a mountain lion might frighten them into a wild rushing stampede, was a job which the lonely herd rider found best done by music.

So under the stars he rode singing to the herd as his mustang's hooves beat out the rhythm. "Good-hy, Old Paint, I'm leaving Cheyenne," he sang, or "When the curtains of night are pinned back by the stars, . . . I'll remember you, love, in my prayers." Sometimes he made up a song about things that had happened — like the story songs — 'The Chisholm Trail', 'The Buffalo Skinners', 'As I Walked Out in the Streets of Laredo', and sometimes he sang, to old melodies that had somehow found their way west, new words that he thought fitted them better — 'Bury Me Not on the Lone Prairie' or 'Red River Valley'.

Often at twilight, after riding herd all day, the tired cowboys gathered where the chuckwagon stood in the delicious odor of hoiling coffee. There, after they had eaten their fill in the light of the campfire, they told each other tales of a rider who never grew weary—the greatest cowboy of them all—Pecos Bill. Pecos, they said, had been hounded out of a covered

wagon and lost when he was only a baby. He was adopted into a coyote family and indeed had not known he was not a coyote until he was 18. Story after story the cowboys told while the fire died to embers and the stars grew brighter above them. They told how Pecos rode a mountain lion using a rattlesnake for a quirt, how he met Slue-foot Sue and gave her a strong whalebone and steel bustle that one day she fell on and bounced over the lower horn of the new moon, and how he founded the Perpetual Motion Ranch. The stories of other heroic cowboy adventures began to lose the names of their heroes and the name of Pecos Bill took their places. Just as in the northern wilds all great deeds were said to have been done by Paul Bunyan, no matter who really did them, so in cow country all remarkable cowboy doings were said to be the work of Pecos Bill.

Folk characters like Paul Bunyan, Tony Beaver, John Henry, and Pecos Bill are almost entirely made

up out of the minds of the folk. There may have been at some past time real persons who bore these names and they may have done things to gain a reputation. But the persons have been forgotten and the wildly impossible character remains to give our minds joy by this very impossibility.

Folk Tales about American Heroes

There are other characters, though, true and important characters out of real American history about whom the folk have chosen to make fanciful stories. From the very beginnings of our country's life as a nation the people have told these stories, adding to them or changing them as they told them in true folk fashion.

To the soldiers who served bravely under Gen. George Washing-

ton in the days of the American Revolution 13 was a very fortunate number and not at all unlucky as folk beliefs have sometimes said. Thirteen was the number of the colonies who were fighting King George III and therefore the best number of all, said the soldiers. General Washington had 13 teeth in both his upper and his lower jaws, they said. And



Tricked by Brer Fox, Brer Rabbit encounters the Tar Baby. This is one of the most popular of Joel Chandler Harris' Uncle Remus stories.

he had 13 hairs on the top of his head under his powdered wig and a tomcat with 13 whiskers and 13 tiger stripes about its body.

Many other great American heroes have been honored by strange tales made up about them by the people. Ethan Allen the bold captain who captured Fort Ticonderoga in the early days of the Revolution said that when he died he would return to his beloved Green Mountains in the body of a fleet pure white horse. So even to this day there are tales over which people shudder as they tell of a powerful white steed that races through Vermont's green valleys when the moon is full.

Johnny Appleseed Travels West

About the time that the battle of Bunker Hill was fought a baby was born in Massachusetts and his proud parents called him John Chapman. Many years later when John Chapman was an old man he had become a queer and lovable character whom folks on the American western frontier called Johnny Appleseed. The old man went barefoot most of the time wore a tin pot for a hat and old cloth sacks for clothing. He wanted one thing only—to carry the apple seeds of the East to the newly cleared lands of the West so that the pioneers might have the juicy fruit to eat.

He made many lonely journeys from the apple orchards of western Pennsylvania to the fertile river valleys of Ohio and Indiana carrying bags of the precious seeds. He gave them away to the homesteaders along the frontier and while he was yet alive he saw wide orchards in blossom promising big harvests of red apples. The Indians no matter how hostile to other white men thought Johnny



P o o E d i s h a s w o y f k h e o f h o w e c a n h o u r y F k a y k e o o d e a m o o n s i n h o n a n d e d e a a s t a t e f a p a r t A a h t i m e s h e d e a w i l d s t a l l i o n n a m e d W d o w M e k e r

Appleseed's mind was different from other men's minds as indeed it was. Having a folk belief of their own that such men were dead to the Great Spirit they let him go wherever he wished without harm.

The white people of the frontier loved him too. They fed him, gave him shelter and told many stories about him. Johnny Appleseed had a way with children who looked for his coming with joy and who always wanted to play with him. And he had a way with animals too—even wild and fierce animals.

Folk tales grew up about Johnny Appleseed's playing with bear cubs while their mother watched them placidly. Wolves and wildcats were his friends as well as the deer and all the other sly and frightened animals. When Johnny Appleseed died, many of the citizens of the nation looked upon the apple orchards of the Middle West and blessed the good old man who had brought the seeds from which they grew. They remembered all the stories that had been told about him. As they told them, they added to them and changed them until John Chapman was no longer a real person whose mind was not as other men's minds, a simple fellow who lived and worked in the days of long ago. To them he had become a folk hero whose memory was celebrated with joy and love.

Crockett, Boone,
and Jackson

Other real people of history about whom the folk have told their stories are numerous. There was, for instance, Daniel Boone, the great scout and Indian fighter. He swung himself across a river on the tough fibers of a wild grapevine, they said, and they told how he scared a bear out of a hollow tree into which the beast was letting himself down, bottom first, by grabbing his tail and shouting loudly at the same

time. There was Davy Crockett, the boastful "Coonskin Congressman" from the Tennessee canebrake. He, folks used to say, could ride the sun around the world and get off where he pleased. He kept a piece of sunrise in his pocket and rode his pet alligator up the waters of Niagara Falls.

Davy was a real congressman and he tried to keep the Congress from taking away from the Creek and Cherokee Indians the lands that had been granted to them by the government. After he failed he went off to Texas to help its people fight against the Mexican army under Gen. Santa Anna. Davy Crockett was one of the brave band of heroes who fought for the independence of Texas at the Alamo until there was no one left alive to fight.

There was Andrew Jackson, "Old Hickory" his soldiers called him, who won the battle of New Orleans against the British in 1815 and was afterward elected president of the United States. The same people who

voted for him used to tell folk tales about him, none better than the one about how he rode to a political convention on the back of an enormous, kicking and spitting wildcat.

The state of New Hampshire had two such real heroes who became folk heroes too. One of these was the pioneer, Ethan Crawford, of Crawford Notch in the White Mountains. He was so strong that once, when a load of hay fell on him with all its crushing weight,

he caught it on his broad shoulders and lifted it back to the body of the wagon. Ethan could talk to the mountain animals and it was even said of him that he once preached a sermon to the wolves who had been attacking his sheep and he made them feel very sorry for what they had done.

The other New Hampshire hero was the great speechmaker Daniel Webster, whose eyes, when he was speaking were said to flash fire and whose voice was like the roll of distant thunder. Many are the tales about Dan'l and his big and hot-tempered ram Beelzebub, about how smart Dan'l was, about the time that he even outsmarted his Satanic Majesty—the Devil himself.

Pirates and Desperadoes
Sometimes folk tales
and folk songs are made

up by the people about characters who were widely known, not for their good deeds but for their crimes. Along the east coast of America a long time ago there were many wicked pirates and smugglers. One of the wickedest of these was the pirate known as Blackbeard, about whose cruel deeds and rich booty there were many stories among the people of the Carolinas.

Another sea rover, folks say, buried his treasures along the banks of the Hudson River. This was Captain Kidd, who is often spoken of as a pirate though the actual historical facts do not seem to prove it. Even today some people still search for the buried loot of Captain Kidd and other pirates and buccaneers.

There were bad folk characters inside the country too as well as along the seacoast. There was Billy the Kid, a young outlaw and desperado, about whom the people of our Far West told many wild tales. And there were Jesse James and his brother Frank, both adventurous outlaws of the Middle West. The people



One of the best loved of American folk heroes is Johnny Appleseed, whose real name was John Chapman. Many tales are woven about the life of this strange, gentle man who brought apple seeds to the frontier in the early 19th century.



From American history have come many colorful figures. Three of them are shown here: Davy Crockett, statesman and frontiersman; Andrew Jackson, whose exciting career led him to the presidency; and Daniel Boone, scout and Indian fighter. Their real-life stories can be found in history books, but folks have built up a host of legends about them.

of Missouri and the states near by still sing a ballad that speaks with scorn of:

The dirty little coward
Who shot Mr. Howard
And laid Jesse James in his grave.

One folk story is told of nearly every American outlaw, the one that relates how he finds a widow weeping because her cruel landlord is coming to get her rent and she is penniless. It goes on to tell how the had man lends her money, telling her to be sure to get a receipt, and how, after the landlord has received the money and given the receipt, the outlaw robs him and takes back the money he has just lent. This tale has been told about Billy the Kid, Jesse James, Ruhe Burrow, and every other American outlaw who has been widely enough known to have folk stories told about him. The people of America love it and they are likely to make any one of a dozen of their favorite outlaws the hero when they tell it.

The Sidehill Dodger and the Hide-Behind

An interesting part of folklore has been the telling by the folk of stories about strange and wildly dif-

ferent animals. The Negro tales about animals have nearly always been about animals that think and talk, but are in all other respects familiar creatures—the rabbit, cow, fox, bear, and so on.

But people who live in mountainous districts love to tell each other about the sidehill dodger who always has to go around a hill in the same direction because the two of its legs on the uphill side are shorter than the two on the down side. In the snowy northwoods, folks talk of the agro-pelter who drops heavy branches covered with snow on the heads of its innocent victims when they happen to walk under the tree where it lives. They sometimes speak in whispers of the hide-behind who follows lonely walkers through the woods but always, when they feel its presence and whirl about to try to see it, quickly jumps behind a tree.

They like to make fun of the filla-ma-loo bird who always flies backward looking at where it has been and never at where it is going. And on the great plains the people who live in the lonely huddles of farm buildings beneath the towering windmills spend pleasant evenings in talk of the wild hodag who has a sharp, curved tail and can be taught to cut wheat with it. They say an educated hodag can run back and forth across the field and leave an even swath each time. They laugh too over the happy auger who can dig postholes by jumping high into the air and coming down hard on its strong, stiff, corkscrew-shaped tail.

Fiddle Tunes and Quilting

Many products of the folk fancy are not tales or songs. They show equally well, however, how eager and clever are the minds of the people that make them up. There are melodies without words—fiddle tunes that tell no story except that told by their folk titles: 'Whole Hog or None', 'Rats in the Meal Bag', 'Wild Goose', 'River Bridge', 'Hop Light Ladies', 'Indian Squaw', 'That Big Black Bear'll Get You, Honey', 'Pop Goes the Weasel', 'Wolves A'Howling', and thousands more.

Many of the women who live in lonely country districts make use of spare hours stitching patchwork quilts of beautiful and



Romantic legends have come out of the lives of such American outlaws as Billy the Kid and Jesse James. The same tales are often told of outlaws in different parts of the country.

wonderful designs. These have folk names such as Log Cabin, Golden Gates Road to California, Lady of the Lake, Solomon's Crown, Wheel of Fortune, Circle Saw, Hearts and Gizzards, and the like.

The quilts show the creative fancies of the people who make them. So do the wood carvings of folks who like to whittle out a likeness of a dog, a skunk, an eagle, a cow while they chat by the hearth fire on long cold evenings. Some of the old folk carvings, particularly those of American eagles, are eagerly sought after by collectors and have become valuable. Once in a while some of the people of a neighborhood will take to decorating their sets of dinner plates by painting on them things they would like to see there—wild turkeys or brook trout or green vegetables. Sometimes they will go further and paint the woods at sunset on the teapot or a forest fire on one of the platters. This too is folk art because it shows a neighborhood's idea of these things.

American Folk Art

Not much painting is done on canvas by the folk. But in some parts of America, especially in Ohio and Pennsylvania, anyone who rides along the roads can see folk designs or folk landscapes painted on the sides and sometimes on the roofs of barns. The signs of some taverns too are folk art that someone has called "outdoor murals." Landscapes or portraits are painted on wooden surfaces and swung above tavern doors to let the traveler know that he is welcome with in. When the American republic was young, there were folk painters who moved from town to town carrying with them canvasses on which the clothed body of a man or woman had already been painted. All that was necessary then was for the folk artist to paint in the head of a subject and a complete portrait would have been finished and ready for sale.

Other folk figures that were familiar to our grandfathers were the figureheads at the prows of sailing vessels and of steamboats, weather vanes made of metal that had been shaped by molds into the likenesses of crowing cocks, flying eagles, trotting horses.

The wooden Indians that used to stand outside tobacco stores, the iron dogs, deer and other iron statuary that once stood on the wide green lawns of big houses are now treasured by many American collectors.

Appreciation of Folklore

Folklore is not only to be enjoyed for itself. It provides a never-ending stream of glittering stuff from which painters and sculptors and writers make pictures and statues, poems and stories. Although the artists of Europe had made use of folklore again and again in their own countries, the artists of America did not at first choose to create their works from the lore of the country's folk. Nathaniel Hawthorne and Washington Irving were among the first of America's great writers to use the legends of their neighborhoods in their writings.

Today the whole nation is aware of the great mass of lore that the folk have provided and still provide. American artists have painted our folk characters many times and here and there throughout America stand stone statues that give us our artists' ideas



Pirates have always fascinated American folk. They loved to listen to tales of Blackbeard, Captain Kidd, and other bold and wicked buccannars who sailed the seas under their black skull and crossbones flag, the Jolly Roger.

of what Paul Bunyan and the rest of our folk heroes looked like. In the vast Library of Congress in Washington, D.C., there is stored a very big collection of phonograph records of folk songs and ballads. Traveling collectors got these records for the collection by going into the mountain woods, the jungle-like swamps, the lonely prairies to get the folk themselves to sing the words into their recording machines. Preserved in record form, these songs can be heard by lovers of folklore long after those who sing them are gone.

Folk singers have sprung up all over America, men who give concerts of folk songs and sing them so well that big crowds go to hear them. Hundreds of albums of records sung by these men are on sale in our record shops. On records too are many of the old stories. They are told by expert storytellers who have delighted groups of children and grown-ups in schools and libraries.

Our motion pictures too have recognized the value of our folklore. Movies that show the stirring events of our country's past, especially the exciting outlaw and cowboy days on the western plains make use of

Some Americans have written plays on folk subjects and thousands have gone to see them, plays like Maxwell Anderson's 'High Tor', Richardson and Berney's 'Dark of the Moon', Marc Connelly's 'Green Pastures'. And there have been folk operas too—like 'The Devil and Daniel Webster', for which Douglas Moore wrote the music and the late Stephen Vincent Benét the words.

American universities have sent their folklore scholars into the neighborhoods where groups of citizens of certain national characteristics live in order more fully to study their folklore. They carry with them recording machines and cameras as well as their notebooks. Reports are being brought back on the folklores of citizens of Mexican blood, Eskimo friends in Alaska, Hawaiian and Virgin Island neighbors. These reports help us understand all the people who make up America.

Folklore a Key to Folks' Minds

Today as never before Americans are aware of the joy that can come to them through understanding the minds of the people of the past. People feel that they know their forebears much better when they know



House-raising and corn-husking bees called for dancing, and fiddlers provided the music. Many still-popular songs and fiddle tunes were first heard at these country dances.

folk songs and folk legends. Jesse James and Billy the Kid ride again on the screen to the joy of millions in the movie audiences. Other motion pictures show the folklore of colonial days, the American Revolution, and the early years of American growth.

what stories they made up, what songs they created and sang—in other words, what their minds found amusing and entertaining.

Stephen Vincent Benét, who wrote many stories based on folklore once wrote: "It's always seemed

to me that legends and yarns and folk tales are as much a part of the real history of a country as proclamations and provisos and constitutional amendments. The legends and the yarns get down to the roots of the people—they tell a good deal about what people admire and want about what sort of people they are. You can explain America in terms of formal history and can also explain it in terms of Rip van Winkle and Paul Bunyan of Casey

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When young Abraham Lincoln kept a country store people liked to listen to his anecdotes. When he was president his sense of humor carried him through trying years. He used many a homesly story to illustrate a serious point.

Jones and Davy Crockett—not the Crockett whose actual exploits are in the history books but the Crockett who was a legend during his lifetime the frontiersman up on his hind legs.

Folklore never stops flowing from the springs of the people's fancy, never stops changing as it flows. Wherever people choose to entertain them elves rather than be entertained it grows. While city people not so dependent on self-amusement as country folk do not give us as many legends and tales as the folk who live among the woods fields and streams there have been even in such crowded towns as New York ghost stories songs of factory workers fanciful characters—Paul Bunyan's of the city slums. Knowledge of a nation's folklore is knowledge of the creative workings of the minds of its folk. It is a key to a nation's values a highway that leads into the heart of its people. (See also Storytelling section Follow ing the Folk Tales Around the World.)

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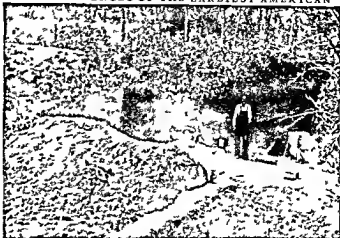
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John Henry, the Negro railroad worker, is the hero of many work songs. Folks sing of John Henry's feats with a sledge hammer and especially of the time he drove spikes into rock faster than a steam drill.

FIRST EVIDENCES OF THE EARLIEST AMERICAN



FOLSOM MAN The earliest human inhabitant of North America may have been in the land between 15 000 and 25 000 years ago, in the geologic epoch called the Pleistocene (see Geology). He ranged over a vast territory from what is now Saskatchewan and Alberta in Canada south to the Mexican border, and from east of the Rocky Mountains across to North Carolina. Archeologists first found evidences of his existence in an arroyo near Folsom, N. M. and so he was given the name of Folsom Man.

The first Folsom Man most likely came from Asia across the Bering Strait to Alaska. He (or his descendents) traveled southward along much the same route now followed by the



At the top is the excavation near Folsom, N. M. where the first Folsom artifacts (products of human workmanship) were found. Bottom at the same site archeologists found this bone Folsom point embedded in a bison bone. Note the distinctive fluting and carefully shaped edges.

Alaska Highway Although most of the northern part of the continent was covered by glaciers during much of the Pleistocene epoch, there was an ice-free corridor east of the Rockies during the last glaciation period. Men and animals could migrate along it.

A Mighty Hunter and a Skilled Weapons Maker

As yet, archeologists have uncovered no skeletal remains of Folsom Man. But though no human bones have been found, there is definite proof of his existence. Folsom Man left great numbers of his flint knives and spear or lance points among the mounds of bones of animals slain in the hunt. Many of the animals were of distinctive Ice Age types.

These points and knives show that Folsom Man was a real craftsman in flint working. The points have a carefully chipped channel or fluting running from the base toward the tip. The flute might have been used for joining the point to the lance, and also to induce greater penetration and bleeding. The points are neatly chipped around the edges, and the knives also show fine workmanship.

Before the Folsom artifacts were discovered in 1927, scientists had no proof that man inhabited North

America much before 1000 B. C. The excavations at Folsom opened up vast new fields of archeological knowledge. Other discoveries near the town of Landemeier and in Yuma County, Colo. gave further evidence that the continent had been peopled since a much earlier time. Finally in a cave in the Sandia Mountains of New Mexico, scientists found artifacts of an even more primitive nature suggesting an even older being than Folsom Man.

FOOCHOW CHINA Thirty-four miles up the river Min from the China Sea stands the city of Foochow or Minhow. This old walled town, with its tall pagodas, has a bustling trade with other coast cities in local manufactures and agricultural products. The river teems with houseboats and junks, frail river craft and smart steam launches. From the interior come small boats laden with fruit, cotton, and rice. Outgoing boats are stacked with tea, timber, paper, bamboo, spices and silk and cotton goods from the Foochow mills. Other exports include fine lacquers, dainty stoneware or soapstone figures, carved ornaments, and artificial flowers.

In town, some of the narrow, dirty streets are almost blocked by crowded displays of goods. The main street runs through the south gate and continues to the river, where it meets the Bridge of Ten Thousand Ages. This structure, more than eight centuries old, connects the river bank with the little island of Tongshan. It was built of enormous slabs of gray granite and is 1 350 feet long.

Foochow lies about midway between Shanghai and Hong Kong and is the capital of Fukien province. The city reached its greatest prosperity during the height of the tea trade in the 19th century. It was one of five original treaty ports created by the Treaty of Nanking in 1842. Until the Communists seized China, Foochow was the seat of Fukien Christian University. Population (1947 est.) 328,434.

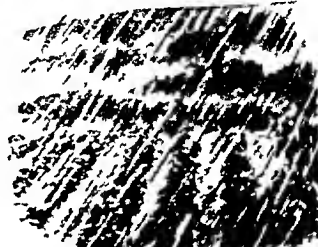
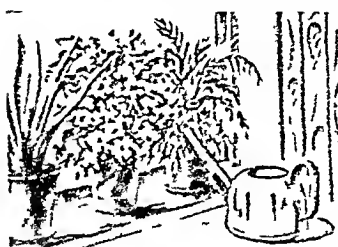
FOOD—A NECESSITY of LIFE



All animals have to eat in order to live. The ones shown here like different kinds of food. Dogs prefer meat. Cats like fish, meat, and milk. Pigs enjoy any kind of food. Cattle eat grass, corn, and other grains. Chickens like grains, insects, and other foods.



The fish above is jumping for an insect. Fish also eat other fish and seaweed. Some wild animals, like the tiger, eat meat. Others, like the deer, eat plants. Different kinds of birds eat different kinds of food, including insects, grains, and fruits.



Food is as necessary to plants as it is to animals. Green plants make their own food if they have plenty of the things nature provides: air, sun, rain, and good soil. Plants supply food directly to plant-eating animals and indirectly to the meat eaters.

FOOD. All living things need food in order to go on living. Food helps them to grow when they are young. It gives strength and energy at all ages. Plants need energy to grow leaves, flowers, and seeds. Animals need it to move around and satisfy their wants. People need energy for work, play, and all the other activities of life.

Green plants are the first food makers. Sunshine helps them to make food from chemicals in air, water, and soil. They use up some of this food immediately in living and growing. They store some away for the future in their roots, stems, fruit, and other parts of their plant bodies. (For pictures, see *Nature Study*, subhead "How Plants Grow and Make Food"; *Plant Life*.) The stored food of plants provides food for all animals and human beings.

Some animals eat nothing but plants. They benefit directly by the food-making habits of plants. Cows



Human beings like many kinds of plant and animal food. Most people in the United States eat a great variety every day.

and horses are of this type. Other animals, including cats and dogs, eat animal foods, such as meat, fish, and milk. They benefit indirectly from the food-making plants. The animals which supply their food may have fed on plants or on plant-eating animals. Human beings eat both plant and animal foods. They eat the seeds or fruits of many grasses (corn, wheat, and other grains), the fruits of trees and bushes (oranges, apples, berries), and food-storing parts of vegetables. They eat the flesh of animals, fowls, and fish, and animal products, including eggs and milk.

Food for Health and Energy

Food is necessary to maintain life. The right food is necessary to maintain health. A plant growing in poor soil, without enough water or sunshine, is weak and puny. Animals which do not get enough of the

right foods lack strength and energy. So too with human beings. Unless they eat the right foods they are not strong and healthy.

One way to be sure of getting the food needed for health is to follow the guide known as "Nutrition and the Basic Seven Groups," shown on this page. Food experts working with the United States Department of Agriculture developed this guide to fit the needs of the American people. It divides the foods which are common in the United States into seven groups according to the kind of nourishment they contain. Some foods appear in more than one group.

In group 1 are green and leafy vegetables—aspargus, green beans, lima beans, broccoli, Brussels sprouts, green cabbage, chard, collards, kale, leaf lettuce and other salad greens, okra, green peas, green and red peppers, and spinach and similar greens. Yellow vegetables—carrots, pumpkins, winter yellow squash, and sweet potatoes—are also in group 1.

Group 2 consists of citrus fruits, tomatoes and tomato juice, cantaloupe, salad greens, and raw pineapples, strawberries, cabbage, green peppers, and turnips. Tomatoes and the citrus fruits are the most important members of this group.

Group 3 includes white and sweet potatoes and the vegetables and fruits not listed in groups 1 and 2.

Group 4 is essentially milk. The group consists of whole skim, evaporated, condensed, and dried milk, buttermilk and the milk products—cheese, cottage cheese, and ice cream.

Group 5 contains all kinds of meat, poultry and fish, eggs, nuts, peanut butter, dried beans and peas, soybeans and soya flour, and lentils.

Group 6 is foods made up of grains, breads, biscuits, muffins, rolls, crackers, rice, and breakfast cereals.

Butter and margarine make up group 7.

The experts who planned the Basic Seven recommend that people eat one serving of food every day from groups 1, 2, 6, and 7 and two from group 3. They advise three to four 8-ounce glasses of milk a day for young people and two or more glasses for grownups. They recommend one serving a day of meat, four eggs a week, and two or more servings a week from among the other foods in group 5.

Some favorite foods do not appear in any of the seven groups. These include cake, candy, pie, spaghetti and macaroni, hominy grits, salad dressings, and jellies and jams. These foods taste good and satisfy the appetite, but they are not as nourishing as the foods in the seven groups. It is not wise to eat so much of them that there is no appetite left for the more important foods.

Millions Work So
That We Can Eat

THERE ARE enough different kinds of food available in the United States so that people

can follow the Basic Seven plan of eating, even though it calls for a great variety. Our grocery stores and markets supply fruits and vegetables—fresh, frozen and canned—the year round. They also carry a large assortment of packaged foods. Meat markets provide

NUTRITION AND THE BASIC SEVEN GROUPS

1. LEAFY GREEN AND YELLOW VEGETABLES 1 serving daily

Vitamins A and C calcium
three members of the vitamin
B complex (thiamine ribo-
flavin niacin) cellulose for
bulk



2. CITRUS FRUIT TOMATOES RAW GREENS 1 serving daily

Vitamin C Citrus fruits and
tomatoes are the best source
because vitamin C is most
stable in an acid medium



3. POTATOES VEGETABLES FRUITS 2 servings daily

White potatoes carbohy-
drate iron thiamine niacin
vitamin C Sweet potatoes
same plus vitamin A Other
vegetables carbohydrate
bulk Fruits carbohydrate
minerals vitamins



4. MILK, CHEESE, ICE CREAM 2 to 4 glasses of milk daily

Milk contains all the essen-
tial nutrients. It is especially
important for animal pro-
tein calcium phosphorus
riboflavin



5. MEAT POULTRY FISH EGGS 1 of 2 servings daily

Meat poultry fish and shell
fish protein iron phosphorus
thiamine riboflavin niacin
Eggs protein calcium phos-
phorus iron vitamin A
riboflavin



6. BREAD FLOUR CEREALS Some daily

Carbohydrate protein also
iron thiamine riboflavin niacin
if the product is made of
whole grain or has been en-
riched with added minerals
and vitamins

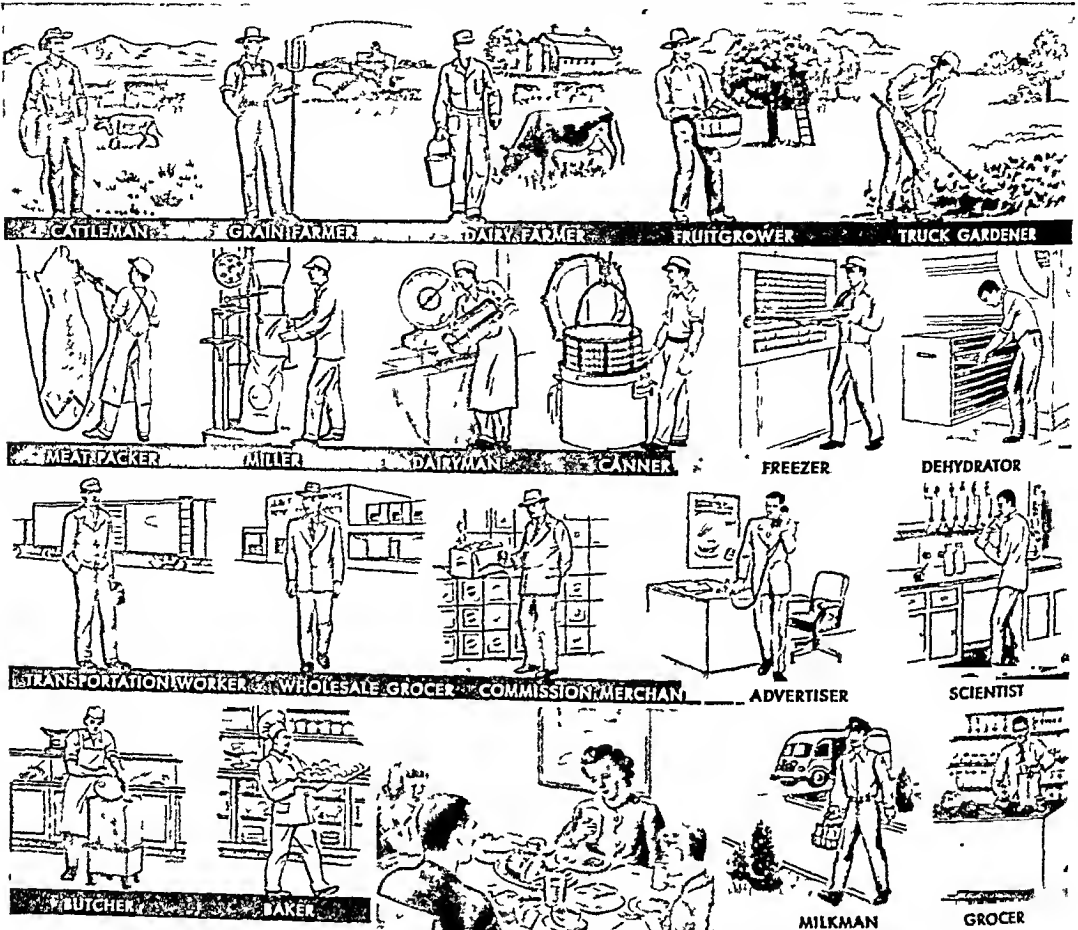


7. BUTTER AND MARGARINE Some daily

Butter vitamin A con-
tented fat Margarine oleo-
margarine fat vitamin A if
fortified by addition of
this vitamin



MANY PEOPLE WORK TO PROVIDE US WITH FOOD



This chart shows some of the many people who work so that we can eat. Most of them raise food, process it, or sell it.

a constant supply of meat, milk, butter, and eggs come into the home by way of the milkman or the neighborhood store. Bakeries and delicatessens supply freshly cooked foods. Many communities have super markets which combine all these types of food stores in one.

This abundance and variety are possible because there have been many improvements in ways of getting food. Scientists and farmers have bred better food plants and animals. Inventors and manufacturers have built machines to help farmers raise more food with less work. They have discovered ways of preserving food so that it can be kept without spoiling until it is needed. Engineers and businessmen have provided means of transportation to carry food to places far from where it is raised. Businessmen perform the work of buying, selling, and transporting food so that it can be sold in stores which the people who produced the food never see.

Millions of people work to carry out different steps in raising, processing, and selling food. More than one fifth of all the people in the United States

who work for a living work in some way with food.

The food workers we know best are those in neighborhood and community stores. They are the retail food dealers and their helpers: the grocer, butcher, baker, and so on. The neighbor who manages a food store may be an "independent." This means that he owns his own store. He may be a member of a "voluntary chain," an association of independent owners who buy from the same sources. He may be a manager for a "regional chain." This is a group of stores owned by one company and located within one geographical area. Or he may be manager for a great "national chain." National chains own stores in all parts of the country (see Chain Stores).

The operators of retail stores buy food in amounts which seem large to home buyers. They keep the food in their stores, or store it, and sell it in smaller quantities to home users.

Wholesale Dealers May Be Neighbors

Wholesale dealers are important food workers who may live in our own community or in one near by. We

may never see them, but we are likely to see their salesmen in the neighborhood store taking orders for supplies from its manager. Wholesalers do for retailers approximately what retailers do for home buyers. They assemble and store in warehouses a great variety of foods in large quantities. They sell this food in smaller amounts to retail stores in their territory.

The *wholesale grocer* buys flour, sugar, and other staples; canned fruits and vegetables; jellies and jams, and packaged foods of all kinds from firms which prepare these items. He imports some foods among them spices from India, coffee from Brazil, tea from Ceylon, and olives from Spain. His purchases come to him by ship, train, and truck. He buys in such large quantities that he gets the lowest shipping rates. For railroad shipment he often buys in carload lots—amounts large enough to fill a freight car.

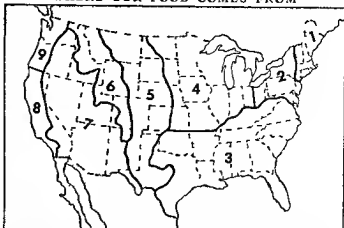
The wholesale grocer employs traveling buyers and salesmen, warehouse clerks to fill orders, and truckers to make deliveries. He sells chiefly to independent retail stores. Chain-store organizations have their own buyers, warehouses, and staffs to serve their stores, just as wholesale grocers serve the independent stores.

Fresh Fruits and Vegetables Go to Market

The people of the United States eat about 115 different kinds of fresh fruits and vegetables. A neighborhood store may have 35 or more kinds on its counters at one time. These figures include only kinds not varieties. About 50 per cent of all the fruits and 60 per cent of all the vegetables raised in the United States are eaten fresh. Many kinds spoil a few days after being picked. Yet they may be grown in California, Texas, or Florida and be sold in Boston, for example, or small towns in Minnesota. Fast, careful handling makes this possible.

Many retail storekeepers buy their supplies early in the morning at local wholesale markets. Some markets are buildings or pavilions where fruits and vegetables are displayed. Others are districts made up of wholesale stores and warehouses. There has to be plenty of space for trucks to load and unload. There may be railroad sidings for boxcar deliveries.

WHERE OUR FOOD COMES FROM



1 NEW ENGLAND	Fish, dairy products, potatoes, sweet corn and other vegetables, blueberries and cranberries.
2 MIDDLE ATLANTIC REGION	Fish, dairy products, poultry, vegetables, melons, grapes, apples, and other fruits.
3 THE SOUTH	Sugar cane, citrus fruits, vegetables, fish, wheat, corn, dairy products, peanuts, cattle, rice.
4 NORTH CENTRAL PLAINS	Corn, wheat, cattle and hogs, dairy products, vegetables, apples, cherries, and other fruits.
5 GREAT PLAINS	Cattle and sheep, sugar beets, fruits, vegetables.
6 ROCKY MOUNTAINS	Cattle and sheep, sugar beets, vegetables, melons and peaches.
7 WESTERN BASINS AND PLATEAUS	Cattle and sheep, citrus and other fruits, sugar beets, potatoes, vegetables.
8 SOUTH PACIFIC REGION	Citrus and other fruits, vegetables, sardines, tuna, and other fish.
9 NORTH PACIFIC REGION	Salmon, tuna, and other fish, fruits, vegetables, dairy products.

Every section of the United States raises food to be used in all parts of the country. This map shows what foods various regions contribute. Because the United States is so large and has so many different kinds of growing conditions, it can raise enough of the essential foods to fill its own needs and some to be shipped to other countries.

Brokers or commission men representing farmers or wholesale buyers may arrange the sales. Some markets in the largest cities have auctions. Many retail dealers do not go to market themselves but deal with *produce wholesalers*. These firms have buyers in farming districts as well as traveling salesmen.

Farmers who live near a wholesale market usually have their fruits and vegetables hauled there by truck. As a rule the driver makes the trip at night, so that the produce can be sold at the market early the following morning.

FOODS FROM OTHER LANDS



- | | |
|--|--|
| 1 Cayenne peppers
Mexico, Nigeria | 9 Sardines
Norway, Portugal |
| 2 Pineapples
Cuba, Mexico | 10 Caraway seeds
Netherlands |
| 3 Bananas
Central America, Mexico | 11 Olives
Spain, Italy, Greece |
| 4 Sugar
Cuba | 12 Chocolate
Africa (Gold Coast, Nigeria), Brazil |
| 5 Ginger
Jamaica | 13 Cloves
British East Africa, Madagascar |
| 6 Nutmeg, Mace
Leeward-Windward Islands | 14 Tea
Ceylon, India |
| 7 Coffee
Brazil, Colombia | 15 Cinnamon
Ceylon |
| 8 Paprika
Spain, Chile | 16 Peppers
India, Indonesia |

Many parts of the world, particularly the tropics, contribute well-liked foods which are not true necessities. This map shows the chief sources of foodstuffs imported by the United States.

When fruits and vegetables are raised far from the market, shipping is more of a problem. Farmers may take their crops to a packing house at some near-by shipping point. There workers sort and pack the produce. A farmers' *marketing cooperative* may own the packing house (*see* *Coöperative Societies*). The produce goes to market by railroad in refrigerated cars. The kinds which spoil the quickest—for example, berries, peaches, peas, and spinach—travel by fast freight (*see* *Railroads*). Choice fruits and vegetables, such as strawberries and okra, may even travel by air. Some fruits and vegetables, however, can be kept for weeks or months if they are stored where it is cold. Wholesalers put them in cold-storage warehouses and sell them as retailers call for them (*see* *Cold Storage: Refrigeration*).

All the food workers mentioned so far except the farmers are *middlemen*. They have this name because they work between the farmers and others who produce food and the consumers who finally buy it. Their business is *food distribution*.

The Great Food-Processing Industries

Most foods require some kind of preparation, or processing, before they are ready for distribution.

Milk has to go through a dairy plant to be pasteurized, or purified. Part of it receives special kinds of processing to become butter, cheese, or ice cream. Animals used for meat are slaughtered in stockyards and processed in meat-packing plants. Milling converts grain into flour. Baking, in turn, makes flour, combined with other products, into bread, crackers, cookies, and so on. Processing grain also makes breakfast cereals.

Sugar has to be extracted, or refined, from sugar cane or sugar beets. Coffee, tea, chocolate, and spices all are prepared in special ways from the raw material—the coffee bean, the cacao bean, the leaves of the tea plants, and the various plants that make spices.

Among the most important methods of processing foods are those designed to keep them from spoiling. Foods spoil because of attack by bacteria or fungi or the work of enzymes (*see* *Food Preservation*). Naturally dry foods, like flour, sugar, and breakfast cereals, will keep for a long time if they are prepared under sanitary conditions and then packaged in airtight containers. But fruits, vegetables, meat, fish, milk, and mixtures of foods have to be specially processed unless they are to be sold and used almost immediately. There are three important methods: canning, freezing, and drying. Each of these methods has given rise to an important industry.

More than a million people in the United States work in the food-processing industries. These industries as a group rank first among manufacturing industries in value added by manufacture and third in number of workers.

The Workers Who Produce Food

Behind the middlemen and the food processors stand the most important food workers—farmers and their helpers. There are more than 10 million of these in the United States. Their work from sunrise to sunset and their ingenuity in using machinery and improved methods make our abundance of food possible. On more than 5 million farms dotting the land they raise the crops that keep us supplied with meat, vegetables, fruit, bread, milk, eggs, and other foods. In addition, more than 150,000 fishermen ply the coastal seas and inland lakes to supply us with fish and shellfish.

Every section of the country contributes its own kinds of foods. The climate, type of soil, and length of growing season determine what the farmer can raise. Nearness of cities is a factor. Dairy and vegetable farms tend to be clustered around metropolitan areas to supply their perishable products to city buyers. The article on the United States tells how these conditions vary in the different sections of the country and what the farmers in each region produce. A map on an earlier page in this article summarizes the products of each section. (*See also* *Farm Life; United States, sections on the various regions.*)

The farmers of the United States raise enough of all the necessary kinds of food to supply the people

of the United States with an abundant and well balanced diet. But some favorite foods must come from the tropics. These include chocolate, coffee and tea. The United States raises a part of its supply of a few foods such as sugar, pineapples, olives and saradines and imports the rest. The map on the preceding page shows the chief sources of the imported foods.

What People Eat in Other Lands

ALTHOUGH the Basic Seven is an excellent plan for eating in the United

States, this does not mean that it is or should be followed everywhere else. Civilizations have developed and grown mighty with far less variety of food. People in many lands today eat according to quite different patterns and remain healthy and strong.

The meals that people eat depend on custom on what they can produce in their own country, on the degree of modernization of their country, on their own individual prosperity and often on their religious beliefs.

Western Europeans like North Americans prefer to plan their main course around an animal product: meat, fish, cheese or eggs. This is true also of Australians and New Zealanders; they are the greatest meat eaters in the world. Meat and other animal products are foods for the well-to-do in most parts of Europe. The poorer people get their nourishment chiefly from grains, the cheapest foods to grow. Usually they make bread from coarse flour. In primitive rural sections they grind the grain into meal and cook it with water into hard cakes or stiff pudding. In mountainous

A MEXICAN WOMAN DOES HER BAKING



The Mexican mother shows above is making tortillas, thin corn meal cakes cooked on a flat pan like a griddle. Tortillas are the "bread" of Mexico.

areas where grains will not grow, potatoes and beans take the place in the diet.

Mexicans build their meals around beans and corn. Rice is the chief food of the Orient. Beans, gourds and dried fish are other staples in India. In China a typical dinner may consist of rice with soy sauce, a little pork or salted fish and a vegetable, perhaps cabbage or salted mustard greens. In out-of-the-way places throughout the world, people eat foods peculiar to their environment. Examples are taro roots in Hawaii; whale fat among the Eskimos; maguey (century plant) in Mexico and Central America; and sea worms on the South Sea Islands. Americans consider these foods strange, but they please the people who eat them as much as our foods please us.

Traditional ways of preparing food are often very important. An Indian mother in Central America traditionally soaks corn meal overnight in lime water. This supplies her children with an important mineral—calcium. The coarsely ground grains customarily used by European peasants contain much more nourishment than finely milled white flour. Unpolished rice, as originally used in the Orient, is rich in food values. When food materials prepared by modern factory methods are substituted for the traditional types or when cooking methods change, important nourishment is lost. Unless variety is introduced into the diet to balance it, undernourishment results.

A NOONTIME DINNER OF RICE



These rice eaters of India seem to enjoy their dinner. Rice, a few vegetables and dried fish are a staple foods of India.

How Different Foods Build Health and Strength

PEOPLE need different kinds of food for different purposes. Some foods are important because they help us grow normally, develop strong bones, and have good teeth. Others are important because they supply energy. Some build a reserve of energy for use if we get sick or for any reason have to miss a few meals.

Foods consist of chemical substances in different combinations. They contain chemical energy. They are produced in their raw state by a great variety of plants and animals. If we understand how they are produced, we can understand their composition and how our bodies use them.

Green Plants Make Food

As stated at the beginning of this article, green plants are the first food makers among living things. They take carbon dioxide from air, water from soil, and energy from sunlight, and with the help of their green coloring matter (chlorophyll) make *glucose*, a kind of sugar. They use some of the glucose as fuel to give them energy for living and growing. They change some into *cellulose*, a woody substance which forms their cell walls. They store some as *starch*.

Glucose, cellulose, and starch have the family name *carbohydrate*. It means that their molecules are made up of carbon and the elements of water—hydrogen and oxygen. These molecules also hold the energy taken from sunlight, converted to a form of chemical energy.

Plant cells contain *fat* and *protein* as well as carbohydrate. Plants manufacture them both from glucose. Fat has the same elements as glucose, but in different proportions. Protein contains, in addition, nitrogen, sulphur, and phosphorus, which plants get from soil. Both fat and protein contain chemical energy transferred to them from the glucose out of which they were made.

Water is also an important part of plant cells. Plants take it up from the soil. It contains various minerals dissolved as inorganic salts: sodium, potassium, calcium, magnesium, and chlorine.

Plants store food for their own use chiefly in the form of starch. But they may store protein or fat in their seeds or fruit for use by the new young plant.

Food Needs of Animals and Human Beings

Animals and human beings also need carbohydrate, fat, and protein. They need them for the same reasons plants do: because their cells are built of them and because these materials contain energy. They use all three materials both to build cells and to get energy, but they use each one differently.

Carbohydrate is most important as a fuel to give immediate energy. Digestion turns it into glucose. The blood carries some of this to cells throughout the body to be used as fuel. The liver transforms

some into a starch called *glycogen* for temporary storage in the liver and muscles. The body uses this stored carbohydrate for energy between meals and replaces it at every meal.

Protein is most important as a building material. Most of the protein eaten goes into cells for growth

and repair. Some, however, is converted into glucose for fuel and some into glycogen for storage. Neither animals nor human beings can make protein in their bodies from the other types of food. Plant-eating animals get all their protein from plants. It undergoes chemical changes in their bodies to become like the protein of their own tissues. It is then more like the protein of meat-

eating animals and of human beings. Thus proteins from meat and other animal products do not have to go through so many changes in our bodies as plant proteins do.

Fat is most important as an emergency source of energy. The body stores it under the skin and around vital organs. It serves not only as a reserve supply of fuel but as insulation and protection. The body does not begin to use fat as fuel until it has run out of stored carbohydrate.

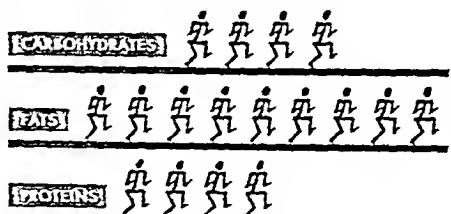
If animals or human beings eat more food—fat, protein, or carbohydrate—than they need for energy and tissue building, their bodies convert all the excess into fat for storage. That is why farmers can fatten cattle and hogs for market by feeding them large quantities of corn and not allowing them to exercise and so use up the energy the corn supplies. It is also why eating too much, regardless of the kind of food, makes people fat. Eating just what the body needs keeps the weight constant. Eating too little makes it thin, because stored fat is used for energy.

How Food Serves as Fuel

Plants and animals use food as fuel by a process which is something like the burning of wood or the combustion of gasoline. We ordinarily think of burning as producing intense heat and flame. That is because burning outside the body is fast, releases energy rapidly, and generates great heat. In body cells chemical substances (enzymes) act as catalyzers to make slow burning possible. This releases energy slowly and generates relatively little heat.

The burning of food (like other burning) is a form of oxidation. In plants and animals, free oxygen unites with molecules of carbohydrate or fat in individual cells throughout the body. The molecules are bound together with the energy which was first incorporated into glucose by a food-making green plant. It had remained through all the changes the original atoms of carbon, oxygen, and hydrogen had undergone. The breakup of the molecules now releases the energy

ENERGY SUPPLIED BY TYPES OF FOOD



for use. It will be remembered that the source of the energy was the sun. All the energy of living things comes originally from the sun. After the breakup and release of energy the atoms of carbon, oxygen and hydrogen form carbon dioxide and water.

Plants get oxygen for burning food as a by-product when they make glucose. They use the carbon dioxide and water which are by-products of oxidation in continuing their cycle of food making (*photosynthesis*) and use of energy (*respiration*). Human beings and the higher animals get oxygen from air through the lungs and blood stream. Blood carries away excess carbon dioxide and water to be discharged as wastes. (See also Plant Life, Blood.)

Scientists measure the amount of energy in different foods by measuring the amount of heat they generate during oxidation. The unit of measurement is the large calorie or kilogram-calorie (see Calorie).

What We Get from Different Foods

A chart on an earlier page shows the contribution of various foods to the diet. Vegetables and fruits for example contribute chiefly carbohydrate. Peas, beans and corn provide protein as well as do grains. Nuts are rich sources of fat, protein and carbohydrate. Other plant foods which contribute fat are olives and olive oil, chocolate, avocados, corn oil and linseed oil. Note that all the plants which supply protein or fat are plants whose fruits or seeds we use.

Vegetables and fruits also provide cellulose. This woody substance is not used as food by the body but it provides bulk and thus helps to regulate digestion.

Animal products provide chiefly fat and protein and of these protein is the more important. It is the only one of the three food materials which the body cannot manufacture from the others. People can live entirely on plant foods if they eat plenty of those which supply protein but it is easier to get enough of this body-building material by including animal foods in the diet. Animal proteins as stated earlier require less conversion in the body.

The Role of Minerals and Vitamins

Minerals are extremely important to the body although they are not energy-producing foods. They make the bones and teeth hard. They are essential parts of muscles and blood cells. As salts in the solutions of the body they affect the working of muscles and nerves, take part in digestion and in general help to keep the body's fluids normal.

Calcium, phosphorus and magnesium are especially important in building bones and teeth. Calcium is also important in the blood and magnesium in the muscles. About 70 per cent of the iron in the body is in the blood where it combines with oxygen as hemoglobin. Salts of sodium are essential in the blood

and other fluids. Potassium is more important in the composition of the solid parts of the soft tissues. Fluorine in the right quantities helps teeth resist decay. In excess it causes mottling of the enamel. Iodine is vital to the functioning of the thyroid.

A well-balanced diet usually contains enough minerals. It is well, however, to watch the diet for calcium (particularly during growth), iron and iodine. Milk is a fine source of calcium, lean meat and eggs of iron. Green leaves of vegetables, fresh fruits and whole-grain products also contain iron. Sea food is rich in iodine. The use of iodized salt may be advisable where sea food is not abundant.

Vitamins like minerals are not energy-producing foods. Yet they profoundly influence health and growth (see Vitamins). A diet well-balanced in other respects usually contains enough of these important substances. Children may need extra vitamin D which is necessary to normal growth of bones and teeth but they should take it under a doctor's direction.

Counting Calories

The amount of food people need as measured in calories depends on their size and age and on how active they are. The National Research Council recommends the following daily allowances:

For children: 1 to 3 years 1,200 calories; 4 to 6 years 1,600 calories; 7 to 9 years 2,000 calories; 10 to 12 years 2,500 calories; girls 13 to 15 years 2,600 calories; girls 16 to 20 years 2,400 calories; boys 13 to 15 years 3,200 calories; boys 16 to 20 years 3,800 calories. For moderately active women who weigh about 124 pounds 2,500 calories. For moderately active men weighing about 155 pounds 3,000 calories. Men who do physical labor usually need from 3,200 to 5,000 calories a day.

A few generalizations can be made about the caloric content of foods. Desserts and candy which usually contain both fat and carbohydrate are concentrates of calories. Among vegetables those with the highest percentage of carbohydrate and therefore with the most calories are corn, green lima beans, sweet potatoes, white potatoes, parsnips and peas. Fruits with the most carbohydrate are bananas, persimmons, cherries, guavas, blueberries, huckleberries, apples and grapes. Nuts and dried fruits have a very high caloric content.

Meat and fowl rank as follows from high to low in caloric count: pork, bacon, sausage, ham, duck, medium fat beef, turkey, lamb, veal, calves, liver and chicken. Fish is rather low in calories.

People who want to lose or gain weight can usually do so by keeping in mind the generalizations listed. If a strict caloric count is necessary, the diet should be supervised by a physician.

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B. Animals A 250-250b L-224c-d

II How the body uses food F 216-17

A. Digestion D-90-2 color picture P 241 teeth T-34 alimentary canal P 244 stomach S-400-1 liver L-277 pancreas H-426 enzymes E-383-9 peptin P 144

- B. The essential elements of food and their function F-216-17, B-145-6. See also in Fact-Index Food, *subheads* carbohydrates, proteins, fats, minerals, and vitamins
- C. How food supplies energy F-210-11, 216-17, L-224d, P-294, R-117: basal metabolism R-118; calorie C-49, F-217, chart F-216; comparative energy values, chart F-216
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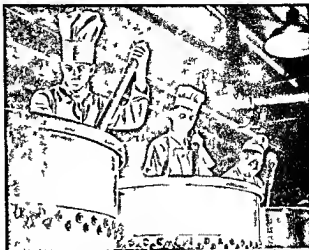
METHODS of Preserving FOOD

FOOD PRESERVATION Food may spoil because microscopic one-celled plants get into it. Some of these are fungi (yeasts and molds). Others are bacteria. We cannot see these little plants but they are present in all air and soil. They get into food from any kind of dirt. Flies and other insects may carry them. Air borne varieties float into food that is left uncovered even in the cleanest kitchen. Once in the food some kinds grow and multiply attacking the food to get nourishment for themselves. The attack makes the food break down or decompose. It is unpleasant to eat and causes illness.

Chemical substances called enzymes also make food spoil. Enzymes are present in all living plant and animal tissues. They help the cells utilize food and discharge wastes. Many of them keep on working after a plant has been harvested or an animal has been killed. This may be an advantage. If fruit is picked while it is still green it will ripen during shipment to market or during storage. Meat and game become tender and improve in flavor if they are stored for a while under sanitary conditions or aged to let the enzymes continue their work. But if the work of enzymes goes on too long food spoils.

Keeping food from spoiling for an indefinite period is called *food preservation*. There are three important methods: the use of heat, the use of cold, and drying or dehydration.

Canning based on the use of heat is the most widely used method. In modern canneries prepared food sealed in airtight cans or in glass jars or bottles is heated in boiling water or steam. This heat kills



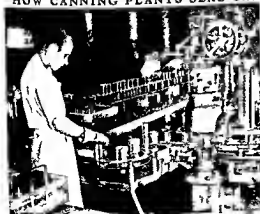
These men are making soup in a canning factory. After the ingredients are thoroughly blended, mechanical stirrers stir the soup into cans. A conveyor belt will carry the sealed cans to a sealing machine.

all bacteria, yeasts, and molds that are likely to grow and spoil the food. It also destroys enzymes. The airtight (hermetic) sealing protects the food from any new invasion of microorganisms.

Preparation of Foods for Canning

Food passes through several procedures at the cannery before it is ready to go into cans or jars. It is cleaned first and then prepared by trimming, peeling, cutting up, and so on. Many foods need preheating or blanching. This means scalding, boiling for a few minutes, or quick steaming. The preheating further cleans the food and kills some organisms. It softens the tissues and forces out air. Some foods are cooked before canning. Navy beans, for example, are baked. Sardines are fried in oil. Soups and other mixed products are heated and stirred until all the ingredients have become well blended.

HOW CANNING PLANTS SEAL CANS OF FOOD AND STERILIZE THEM



The man in the picture at the left is starting unsealed cans of food on a conveyor belt. The cans pass through a sealing machine. This machine seals the cans. The man in the picture at the right shows soup being sealed after it has been canned. Steam water pressure is used to seal the cans. The picture at the right shows soup being sealed after it has been canned. Steam water pressure is used to seal the cans. The picture at the right shows soup being sealed after it has been canned. Steam water pressure is used to seal the cans.

CANNING A BUMPER CORN CROP



Filled cans must not contain much air. If they do, too much oxidation of the food will occur during sterilization. And the pressure inside the can may rise too high. When food goes into cans hot, air is not a problem. Heat has expanded the food, expelling air. As the food cools after processing, it contracts and a partial vacuum forms. But when cool food goes into cans, excess air must be "exhausted." One method is to pass filled cans through hot water or a steam chamber on their way to the sealing machine. The heating expels excess air. Or the cans may be sealed in a high-vacuum chamber. This type of sealing removes air mechanically.

Different kinds of food need different amounts of heat for sterilization. Spores of bacteria are the hardest of all spoilage agents to destroy. Boiling, even for several hours, may not kill them. But acid discourages the growth of bacteria. Therefore foods containing a high percentage of acid can be sterilized by boiling. Such foods are tomatoes, rhubarb, and fruit. Vegetables other than tomatoes are nonacid. They require heating at a temperature higher than the boiling point. This is accomplished by means of steam in a closed vessel. Years of scientific experiment have demonstrated exactly the right degree of heat and the heating period necessary to sterilize each kind of canned food.

Machines controlled by skillful operators carry out almost all the processes of commercial canning. There are machines for shaking dirt out of vegetables and fruit, for washing, for trimming and peeling, for cutting up, and for grading pieces as to size. There are

machines for such complicated procedures as cleaning and preparing fish; peeling, coring, and slicing pineapples; husking corn and slicing the kernels off the cob. There are *filling rigs* that drop exactly the right amount of food into each can, seal the cans, and pass them on to the sterilizing machines. There are machines for labeling cans and for packing them.

A series of conveyor belts connects these machines. A conveyor picks up the fresh foodstuff at the receiving platform of the cannery and starts it on a continuous journey through the plant. At the end of the assembly line the processed food appears in labeled cans, packed in cartons, ready for shipping.

"Tin" Cans Are Not Tin

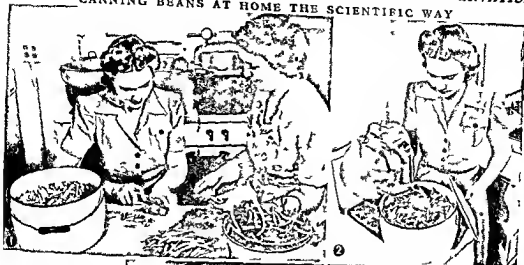
Many foods are preserved by canning methods in jars or bottles. Even so-called tin cans are not really

tin. They are made of thin steel sheeting coated inside and out with a 0.00003 inch layer of tin. A factory "can line" of machines turns out about 300 cans a minute. One machine cuts out body blanks. Another bends the edges for side seams. A third forms the cans and locks the seams. Other machines cut out the bottoms of the cans and attach them by means of double seams containing a sealing compound. The cannery's sealing machine uses a similar double seam to seal on the tops of the cans.

When corn, peas, and other sulphur-containing foods come



1. A factory worker feeds corn into a machine in which rotating knives cut the kernels off the cob. The kernels drop into a conveyor and travel to another part of the factory for canning. 2. Here workers are packing sealed cans of corn into a rack which fits into a sterilizing vessel. 3. In these big sterilizing vessels steam heats the corn at 250° F. for 70 minutes.



in contact with tin iron sulphide forms. This discolors the food. The discoloration is harmless but it makes the food less attractive. Contact with tin bleaches some brightly colored fruits. Cans for these types of foods go through an extra process. When they are still in the sheet-metal stage the side that will form the inside of the cans receives a thin coating of lacquer generally called enamel.

Standard Goods in Standard Quantities

In the United States, the Federal Food Drug and Cosmetic Act prohibits marketing of canned foods that are not pure and nutritious.

Canning firms often grade fruits and vegetables as to size, color, degree of ripeness and freedom from blemishes. They most frequently use the terms Fancy, Choice and Standard. They may use the terms Grade A, Grade B and Grade C. Then their products must meet the requirements set by the Department of Agriculture for Fancy (Grade A), Choice (Grade B) and Standard (Grade C).

The canning industry has standard and numbered the sizes of cans. The housewife knows that when she orders a No. 2 can it will contain 1 pound 4 ounces or 2½ cups. Other popular sizes are No. 8½ weighing 8 ounces, No. 1 picnic or easy 11 ounces, No. 1 tall 167 ounces, No. 2½ almost 2 pounds and



In this series two home economist members of the United States Department of Agriculture show how to can snap beans. 1 They wash the beans and cut them into small pieces. 2 To prevent the beans from bursting, they boil them for about five minutes, or until the beans will bend without breaking. 3 One woman pours the preheated beans into hot glass jars. The other fills the jars to one-half inch from the top with the hot cooking liquid, adds a teaspoon of salt to the quart, and adds self-sealing caps. 4 The jars are arranged in a rack so that they do not touch and are lowered into a pressure canner. Process at time for beans to quart jars is 25 minutes at 10 pounds pressure.

No. 3 2 pounds 3 ounces. Strained foods for babies usually come in 4¼ to 5-ounce cans. The exact weight depends on the bulk of the product.

Dry Canning for Dry Foods

One so-called canning method does not involve cooking. This is vacuum packing. Coffee, nuts, popcorn, dried fruit or other dry food is packed into cans or jars. A machine seals these in such a way as to extract all the air. Dry foods packed by this method keep their flavor much longer than those put up in ordinary packages.

Home Canning Has Become a Science

Home-canning methods today are almost as scientific as factory canning. The housewife works with

LOCKERS THAT KEEP FOOD FROZEN



This picture shows the refrigerated-locker method of keeping frozen foods. There are more than 10 000 frozen-food locker plants in the United States. They serve more than 4 million homes and handle about 3 billion pounds of food a year.

small quantities of food. She uses kitchen utensils instead of machines. She is more likely to use jars than cans. But she follows essentially the same procedures as those used in large canneries. These are: preheating, filling the jars, exhausting the air (unless vacuum or self-sealing jars are used), sterilizing acid foods in a boiling-water bath, and sterilizing nonacid foods in a pressure canner.

Oven canning means sterilizing filled jars by heating them in an oven. This method is not as efficient as the other two methods, and it causes more accidents during canning.

Cold pack is a method of filling jars preparatory to sterilization. The food is put into jars without preheating, and water or syrup is added. The method may be used for some small fruits. It is not usually recommended, however. The fruit, not previously heated, shrinks during sterilization. This leaves the jars only partially full.

In the old-fashioned open-kettle method, boiling in an open vessel takes the place of both preheating and sterilization. Jars and caps must be sterilized. There is danger that microorganisms will enter the

food during filling. Pouring the food boiling hot into hot jars minimizes this danger. The open-kettle method is not safe for nonacid foods.

The home canner should obtain full, reliable instructions. Wrongly canned food may cause dangerous illness. The United States Department of Agriculture and state experiment stations issue bulletins containing complete instructions for home canning.

Cold as Well as Heat Preserves Food

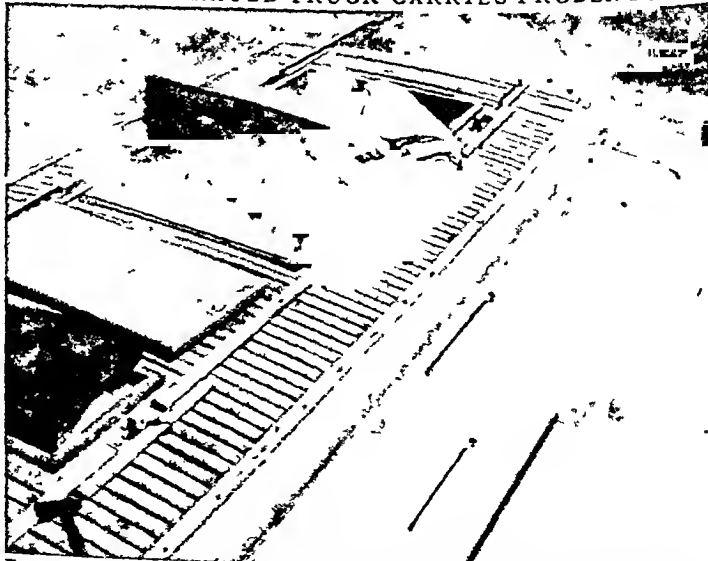
Every time we put food into the refrigerator we make use of the fact that cold preserves food. Cold-storage plants utilize this fact on a large scale. But we usually think of home refrigeration and cold storage as *storage* rather than as food preservation in the modern sense. If cold is to *preserve* food for a long period, the food must be frozen.

Food preserved by any other method than freezing spoils in time. But frozen food—meat, at any rate—may keep indefinitely. In 1901 an expedition of the Russian Imperial Academy of Sciences dug the body of a prehistoric mammoth out of a frozen cliff beside the Berezovka River, about 60 miles within the Arctic Circle. A member of the expedition reported to the Smithsonian Institution that meat from parts that had been continuously frozen looked as fresh as well-frozen beef. The dogs of the expedition ate it with relish.

Although people in cold countries have used freezing to preserve food since ancient times, quick-freezing developed from modern inventions (*see Refrigeration*). Quick-frozen foods first appeared on the market in the early 1930's. Today we have frozen fruits, vegetables, meats, and even frozen pies.

Freezing does not sterilize food. It only stops the action of microorganisms and enzymes. When the

THIS REFRIGERATED TRUCK CARRIES FROZEN FOODS



Frozen foods have to be taken at very low temperatures from the freezing plant to warehouses and from warehouses to stores. This truck for transporting frozen foods is refrigerated by means of dry ice kept in large containers in the roof.

food thaws conditions are ideal for these agents to become active again. For this reason the housewife cooks frozen vegetables immediately after thawing. She stews left-over thawed fruit unless she is going to serve it within a short time. She cooks meat within 24 hours after thawing it.

Frozen food should not be refrozen after it is thawed. In refreezing the advantages of quick freezing are destroyed. Ice crystals form slowly and they grow large. Their growth breaks down the cells of some foods. In addition changes take place in the food's basic colloidal system. Transporting and storing of frozen foods should be at about zero temperature. This prevents loss of vitamins. It also prevents changes in temperature which may allow the food to thaw and then freeze again.

People can have food frozen for them at refrigerated locker plants (see Cold Storage). They can store frozen food in lockers at these plants. Or they can keep it at home in special containers called deep freezers. Frozen foods should not be stored in the home refrigerator unless it contains a freezing locker in which the temperature is maintained at about zero.

Both Nature and Man Preserve Foods by Drying

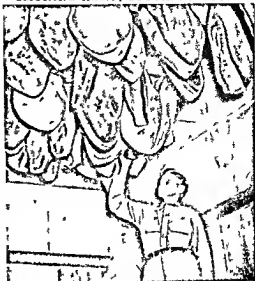
Bacteria, yeasts and molds cannot grow and enzymes cannot work without moisture. That is why drying food preserves it. Drying is nature's own method of food preservation. Grains, peas and beans, after they have ripened dry on the plants that bore them. If such foods are stored in a dry place at an even temperature and are protected from insects and rodents they will keep for a long time. Raisin grapes, figs, dates and other sweet fruits lose water after ripening especially in the hot sunny lands where they grow best. The water loss raises the concentration of sugar. This tends to preserve the fruit.

Just as in prehistoric times, men still dry food in the sun, particularly fruit and fish. But modern methods are more efficient. We also evaporate food in warm ovens or kilns in which a natural draft keeps the air circulating. We dehydrate food with drafts of conditioned air forced by fans.

An evaporating kiln may be several stories high. Each "floor" is a grating or tray to contain food. Heated air rises from a furnace or from steam pipes in the basement on the top grating. As it dries it is lowered from floor to floor until it reaches the lowest level, where the final drying occurs. Apples, potato starch, and hops are among the foods evaporated in kilns.

Dehydrators are of several types. In the *tunnel* dehydrator, trays of vegetables on trucks move through a tunnel while a blast of hot air blows across them.

SMOKING HAMS, SOUTHERN STYLE



This picture shows hams being cured with hickory wood smoke on a farm in Tennessee. Big meat-packing houses follow similar methods. But they have more elaborate equipment so that they can handle large quantities of meat at one time.

In the *anhydrator*, vegetables on a wire-mesh conveyor belt are exposed to heat radiated from above as they pass over hot plates. Meanwhile a high-speed current of hot air tumbles them about.

Tomatoes and other foods that need not retain their shape are usually dehydrated on a *drum drier*. The food is reduced to a paste and spread on a steam heated

drum. One revolution of the drum, taking from 10 to 20 seconds, completes the drying. The food comes off in thin crisp sheets which are broken up into flakes or crushed into powder.

A *spray drier* is used for making powdered milk. Concentrated milk and hot dry air are blown into a chamber through concentric pipes. The milk dries almost instantly and the food solids settle as a powder to the floor. A conveyor takes the milk powder to an outlet.

Meat may be cubed, cooked, ground and dried slowly. Or it may be ground raw and partly dried on hot revolving drums. Then it is peeled off and the drying is finished in cabinets.

Different foods require different kinds of treatment before drying. A label "treated with sulphur dioxide" may appear on packages of dried apricots, peaches, or pears. Exposing these fruits to the fumes of burning sulphur before drying them prevents loss of color,

DRYING VEGETABLES AT HOME



The woman shown above is drying carrots in an electric oven drier. The home dehydrator is usually an insulated cabinet with shelves, electric heater, thermostat, and fan.

The fresh food is put on the top grating. As it dries it is lowered from floor to floor until it reaches the lowest level, where the final drying occurs. Apples, potato starch, and hops are among the foods evaporated in kilns.

Dehydrators are of several types. In the *tunnel* dehydrator, trays of vegetables on trucks move through a tunnel while a blast of hot air blows across them.

kills insects, and aids drying. Prunes and some raisin grapes go through a preliminary dip in a weak lye solution. This removes their waxlike coating and slightly cracks the skins so that drying is faster. Large vegetables are cut up. All vegetables and some fruits are blanched, usually in steam. This softens them and destroys enzymes.

There are hundreds of dried, evaporated, and dehydrated foods on the market. Especially popular in the home are raisins, prunes, and apricots; soups and sauces, and dried vegetable flakes. Many bakeries and other food manufacturers use dried eggs and milk because they are cheaper than the perishable fresh products. Explorers and armies in combat find dehydrated foods useful not only because they keep well but because they have so little bulk and weight.

Harmless Chemicals Preserve Foods

The use of salt and the use of smoke are ancient ways of keeping food from spoiling. Vinegar is another very old preservative. By Biblical times men had discovered that fermented fruit juice would keep. They had also learned that vinegar, a type of fermented fruit juice, would preserve many foods.

Salt, wood smoke, and vinegar are all chemical means of preserving food. In salting, people spread dry salt over food and leave it there for some time. Or they soak the food in brine. In preserving with vinegar, they steep, or soak, the food. Smoking is done by hanging food in a smokehouse where smoke from a constantly burning fire reaches it. As the chemicals of these preservatives get into the tissues of food they destroy or slow down the action of the spoiling agents. Smoking and salting also partially dry food.

These methods produce strong flavors. Today we use them only for foods with which the flavors combine especially well. Cucumbers, onions, and other vegetables are preserved in brine and then steeped in vinegar to make the pickles we like as relishes. Some kinds of fish and meat are salted, smoked, or pickled.

There is a fourth chemical method of preserving food, much newer than the other three—the use of sugar. It did not become popular until the 18th century, because until then sugar was scarce (see Sugar).

Sugar could be used to preserve any kind of food, but the flavor is best with fruit. Also, the chemical action of sugar is especially efficient with fruits because they are acid. A 40 to 50 per cent sugar solution added to fruit stops the action of bacteria and checks that of molds and yeasts. If the fruit and sugar are cooked together, molds, yeasts, and enzymes are completely destroyed. Fruit properly cooked with sugar and sealed in sterilized, airtight containers keeps indefinitely. Cooking fruit with sugar to make jellies, jams, marmalades, fruit butters, and fruit preserves is a part of the big food-canning industry. It is also the most popular home method of food preservation.

Electronics and Food Preservation

Most modern of all types of food preservation is the use of electrons. A high-voltage electrical appa-

ratus releases free electrons into prepared food in airtight containers. The irradiation lasts only 1/10,000 to 1/1,000,000 of a second. This is long enough to stop the action of enzymes and the growth of bacteria, yeasts, and molds. But it is so short that undesirable chemical reactions do not have a chance to develop in the food.

The method makes use of an apparatus called a *capacitron*. The capacitron receives ordinary 220-volt alternating current and converts it to direct current. A central condenser tower consists of banks of capacitors charged over resistances. Each bank doubles the voltage until it reaches 4,500,000. A specially designed vacuum tube converts this tremendous energy into short bursts of high-speed electrons. It discharges these into an irradiation chamber containing the food to be preserved.

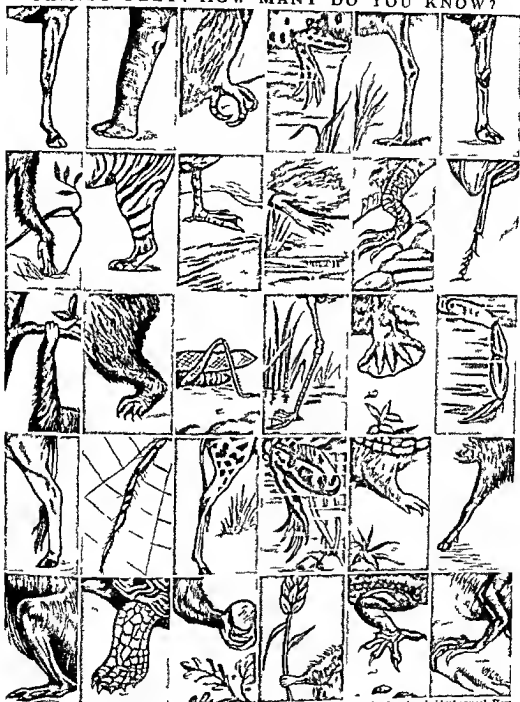
The scientists engaged in developing this method believe that it will provide a more convenient and more effective means of preserving food in its natural raw state than any now in commercial use.

FOOT. In the simplest forms of animal life we do not find special organs for locomotion. In one-celled animals, such as the amoeba, a bit of the living substance is pushed out and then the remainder of the body is pulled up to it. The movement of the worm is somewhat similar; one section of the body is thrust forward and then the other parts are brought up by a creeping or crawling motion. As we ascend the scale of animal life, we find definite organs developing to move the animal about. These organs, which we call feet and legs, occur most commonly in pairs of two, four, or six.

Comparison of the foot in various animals shows many interesting adaptations. In the human foot we distinguish the ankle (*tarsus*), the instep (*metatarsus*), and the toes (*phalanges*). The heel rests upon the ground, making what is called a "plantigrade" foot. The bear also has such a foot. Other animals, like the cat and dog, walk on their toes, or digits. They are said to have a "digitigrade" foot, with the heel up in the air and the instep lifted away from the earth. In deer, cattle, horses, and some other animals, the elevation of the heel has been carried further, and the animal stands on the tip-end of a single toe; the heel, instep, and digits are then away from the earth and only the tip end of one toe is in contact. Animals with the digitigrade foot are much swifter than those with the plantigrade type.

The horse has the most remarkable example of a modified foot. Not only are the heel and instep off the earth, but the bones of the instep have become reduced to one, and the animal walks upon the tip of a single toe on each of his four feet. Fossils found in rocks show that the foot of the horse of the present day developed from the foot of a prehistoric five-toed ancestor by suppression and consolidation of parts. Scientists estimate that it took a period in geologic history of over 50 million years for these changes in the horse's hoof to occur (see Horse). The animals which have feet most nearly resembling

THIRTY FEET! HOW MANY DO YOU KNOW?



Just as a good shoemaker makes shoes to fit the feet, Nature makes feet to fit the needs of each individual animal. How many of these feet could you name? They are from left to right: first row—elephant, eagle, owl, ostrich, camel; second row—chimpanzee, tiger, duck, warbler, crow, bee, lizard, sloth, bear, locust, flamingo, duckbill; third row—styxus, crab, fourth row—ox, garden spider, giraffe, frog, armadillo, peacock; fifth row—kangaroo, box turtle, squirrel, harvest mouse, gecko, iguana.

those of man are the monkeys and apes. But their feet are more like hands, for the great toe can be used like a thumb, and there are no arches in their feet, such as man has developed.

The human foot is beautifully adapted to the work it has to do. Its many small parts, like those of a delicately balanced machine, are perfectly coordinated and adjusted to bear the weight of the body and to carry us over the ground. It has 26 bones (see Skeleton). Held in place by ligaments, tendons, and muscles, the bones form two main arches—one from heel to toes, called the *longitudinal arch*, the other across the instep, called the *transverse arch* or *mediolateral arch*. These give the foot strength and support the body's weight. The longitudinal arch adds spring to the step. It rests on thick muscle, which softens the jolting as the weight of the body is shifted from one foot to the other in walking or running.

The movement of the foot is largely controlled by the muscles of the lower leg, which are attached to it by tendons passing through the ankle. The ankle, above the heel, has a joint which acts as a hinge between leg and foot. The toes are jointed, so that the

foot bends easily and the motion of walking is almost as smooth as the rolling of a wheel.

In walking one should point the feet straight ahead and shift the weight from heel to toes in such a way as to give one the feeling that the toes are gripping the ground at the end of each step.

No machine deserves better care than the foot. It should be rested frequently and bathed daily. Stockings that are smooth, well fitted, and free of darns help prevent blisters, calluses, and corns. Shoes should be fitted with extreme care. A good shoe has a straight inner line, a flexible inner shank, a broad toe, and a broad low heel. An ill-fitting shoe may cause bunions or even dislocate bones. The condition called "broken or fallen arch" is really a displacement of the bones of the arch. It is sometimes incorrectly called "flatfoot," which is a permanent deformity of the bones of the foot, originating in infancy or peculiar to certain racial types.

The foot as a measure of length comes from the assumed length of the human foot, and is very old. The Greek foot was 12.45 inches long, the Roman, 11.65 inches, and the French, 12.8 inches.

SPORT and STRATEGY of the GRIDIRON



The forward pass has helped to make football a favorite game of millions of spectators because it provides a fast, open style of play, easy to watch. Above, player No. 13 is hurling a perfect pass to player No. 22, at the extreme right.

FOOTBALL. The king of autumn sports in the United States is football. It holds sway from the close of the baseball season until basketball begins. No game demands more teamwork, strength, courage, and alertness, or provides a more thrilling spectacle—and few games have as lively a history.

Football is the chief sport in most colleges and universities as well as in thousands of secondary schools. It is also played by teams representing cities, playgrounds, and industrial organizations, as well as by teams of professional players. Its legions of players, however, are but a handful in comparison

with its spectators. The millions of dollars spent each year for tickets to football games have built mammoth stadiums. Those at Stanford University, Ohio State University, and the universities of California, Michigan, and Pennsylvania can each seat 75,000 persons or more. City stadiums, too, are used for football. Soldier Field in Chicago, the Philadelphia Municipal Stadium, and the Los Angeles Coliseum each hold more than 100,000. The Rose Bowl at Pasadena, Calif., can seat about 90,000.

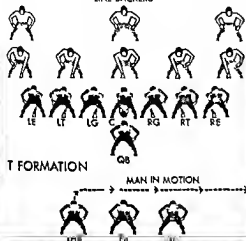
The name "football" has been used for several different games, including soccer and Rugby. These will

FOUR OF FOOTBALL'S MOST POPULAR FORMATIONS

5 3 2 1
DEFENSE

SECONDARY

LINE BACKERS



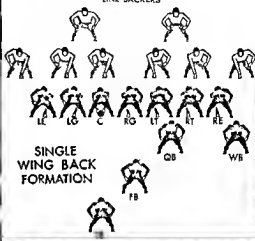
T FORMATION

MAN IN MOTION

6 2 2 1
DEFENSE

SECONDARY

LINE BACKERS

SINGLE
WING BACK
FORMATION

The T-formation takes its name from its backfield pattern. The men in motion usually acts as a decoy, runs up laterally to the right or left before the ball is snapped. The 1-3-2-1 defense is best against quick opening plays and passes. The single wing back formation uses a fullback and wingback (from which it gets its name). It features an unbalanced line with power plays to the "strong side." The 6-2-2-1 defense has all around strength against every type of attack.

be described later in this article. But to most people in the United States the word "football" means the game played by American colleges. In other countries this is called "American football." The regulations for amateur play are made by the National Collegiate Athletic Association (NCAA). Professional teams use almost the same playing rules.

The Field and Equipment

Football is played on a rectangular field, 300 feet long and 160 feet wide. White lines cross the field at 3-yard intervals giving it the appearance of a gridiron. At each end of the field is a goal with two upright posts and a crossbar. The uprights are more than 20 feet high and 18½ feet apart. The crossbar is 10 feet above the ground. In amateur football, the goal is 10 yards behind the goal line. In the professional game it is on the line.

The ball consists of a rubber bladder inside a leather cover. The bladder is inflated to a pressure of about 13 pounds to the square inch. It is oval in shape and measures about 21 inches around the middle. The measure around the ends is about 23 inches. The ball weighs from 14 to 15 ounces.

The Teams Line Up for Battle

The game is played between two teams of 11 men each. Team positions are as follows: Line—left end,

left tackle, left guard, center, right guard, right tackle, right end, backfield—quarterback, left halfback, right halfback and fullback (see diagram above). A member of the backfield is often described by his playing assignment such as *blocking back*, *tailback*, or *wingback*. Any player may be replaced by a substitute at any time.

Before the game starts the referee tosses a coin in the presence of the two opposing captains. The winner of the toss has the choice of (1) kicking off or receiving or (2) the choice of goals. If for example, the winner chooses to kick, the loser can select his goal.

The defensive team kicks off from its own 40 yard line. The player who receives the ball from the kick off immediately runs it forward. His teammates form interference to prevent the opponents from tackling him. When the ball carrier has been tackled or *downed* the teams take positions facing each other across the line of scrimmage (an imaginary line that runs the width of the field and passes through the ball). The team with the ball must have at least seven men on the line of scrimmage. Only one member of the attacking team may be in motion before the ball is passed back from the center. He may run laterally toward either sideline. The defensive players

may take any position across the line of scrimmage that they choose.

One man, usually the quarterback, decides in advance the exact play to use. In a secret *huddle* with his teammates, he calls the play and the signal upon which the center will snap the ball back between his legs. The passing of the ball from center puts it *in play*. The attacking team must hold its huddle and put the ball in play within 25 seconds or be penalized.

The attacking (offensive) team must advance the ball at least 10 yards in no more than four tries (called *downs*). If it makes the necessary yardage it receives a new series of four downs. If it fails on its fourth down, the ball automatically goes back to the other team.

How the Attackers Gain Ground

The team in possession of the ball may carry on its attack (offense) in one of three ways—running with the ball, passing the ball, or kicking the ball.

Running plays offer the safest way of making moderate gains. One of the offensive players, usually a backfield man, carries the ball. The play may go through center, off tackle, or around one of the ends. The ball-carrier's teammates try to clear a path for him by *blocking out* opposing tacklers. The clever ball-carrier aids his own advance by hard running and dodging or by *straight-arming* enemy tacklers. He may run as far as he can until the referee's whistle indicates he has been "downed" or has run out of bounds.

Pass plays are more spectacular and when completed usually gain more ground. One of the backfield men receives the ball from center and throws it to a teammate. If the pass is successful, the receiver may run with the ball as far as he can. The ball may be thrown backward or to the side (*lateral pass*) without restrictions. But if the throw carries the ball closer to the opponents' goal line (*forward pass*) the pass is subject to definite restrictions. The passer must be behind the line of scrimmage. The ball may be caught only by a teammate who was stationed at one end of the scrimmage line or at least one yard behind the line at the beginning of the play. Any member of the opposing team, however, is eligible to catch (*intercept*) a pass. If a pass is not caught, it is *incomplete* and it counts as one down.

The most common kicking play is the *punt*. A player punts by dropping the ball on his foot and then kicking it. The quarterback usually calls for a punt on fourth down when he sees that his team might

not make the necessary ten yards and would therefore lose possession of the ball. A punt surrenders the ball to the other team but a good kick will send the ball about 40 yards down the field.

A *drop kick* is used only for scoring purposes. It is made by dropping the ball and kicking it just as it touches the ground. A kick from placement (*place kick*) is made by kicking the ball from a fixed position on the ground. The ball is often held in position by a teammate of the kicker. Place kicks are used for

scoring purposes and for kickoffs at the start of each half and after each touchdown or field goal.

Why Teams Must Obey Rules

Yardage is also gained or lost through penalties, imposed for breaking the rules. A penalty against a team moves the ball closer to its own goal line. Common penalties are:

Five-yard penalties—off side, crossing the line of scrimmage before the ball is snapped from center; player illegally in motion before the ball is snapped; illegal shift; illegal procedure; and any deliberate delay of the game.

Fifteen yard penalties—clipping, blocking from behind; holding, by member of either offensive or defensive team; unnecessary roughness; and unsportsmanlike conduct.

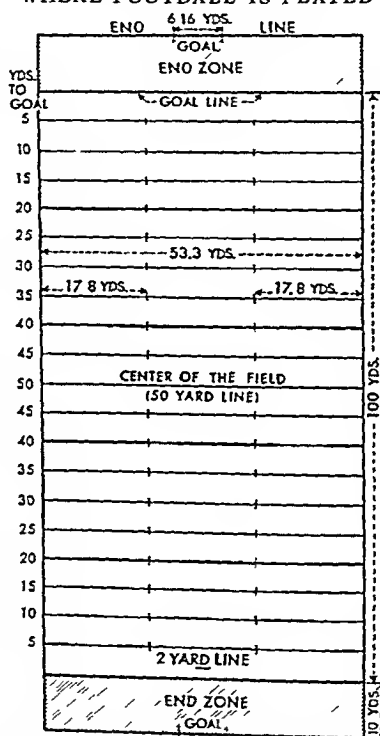
If the penalty distance would carry the ball across the goal line or inside the one-yard line the ball is put in play on the one-yard line. While the ball is within the one-yard line all succeeding penalties are enforced to one half the distance to the goal.

How Teams May Score

A team crossing the opponents' goal line by carrying the ball or by completing a forward pass scores a *touchdown* (6 points). This also entitles the scoring team to try for an extra point (called *point after touchdown*) from scrimmage on the opponents' two-yard line. The score may be made by place-kicking or drop-kicking the ball over the crossbar between the goal posts; by forward passing; or carrying the ball across the goal lines. A *field goal* (3 points) may be scored from scrimmage by place-kicking or drop-kicking the ball over the crossbar between the enemy goal posts. A team may score a field goal from any part of the field. After a touchdown or a field goal, the team scored on has the choice of kicking off or receiving.

A *safety* (2 points) is scored by the defensive team when it tackles the man with the ball behind his own goal line. A *dead ball* (one that goes out of bounds) behind the goal line is also scored as a safety if the force or impetus which sent the ball across the goal line came from the team defending that goal. But

WHERE FOOTBALL IS PLAYED

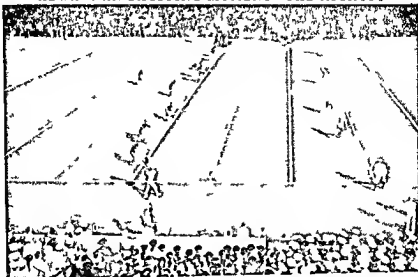


This is a regulation amateur football field. Inbound lines are indicated 17.8 yards inside the sidelines by marks on the 5-yard lines. If a play ends outside either inbound line, the ball is put on the line for the next play.

ALWAYS AN EXCITING MOMENT—THE KICKOFF

if the ball is kicked over the goal line it is a *touchback* and no points are scored. After a safety or a touchback play is resumed from the 20-yard line of the team having possession of the ball.

Actual playing time is 60 minutes divided into 15-minute quarters. At half time there is a 15-minute rest period. Time-outs are often granted for injuries rest or a team conference. Incomplete forward passes and plays going out of bounds all stop the clock. High school games



The man in the center of the line at the left has just kicked the ball. The opposing players are moving into formation to protect the player (not shown) who will catch the ball and try to run it back.

are limited to 48 minutes of playing time divided into 12 minute quarters. (For a table of common football terms see Football in this FACT-INDEX.)

The officials include a *referee* who has general control of the game and sole authority to determine whether or not a score is made, an *umpire* who has charge of the equipment, conduct and position of the players, a *linesman* who supervises the measurement of the distances gained or lost, and a *field judge* who times the game and assists the other officials.

The Money Side of Football

Football in the United States has become a fairly big business. Total income from intercollegiate games amounts in a good year to an estimated 100 million dollars. This money pays the expenses of the first or varsity squad and also supports games between B teams and 150-pound teams. In addition it helps pay for intramural sports and minor intercollegiate sports that cannot pay their own way.

Most of the income from games, however, goes to pay the cost of the sport itself. Large sums must be spent each year to keep up and pay for stadiums and pay salaries of the coaching staff as well as trainers and physicians. The cost of a football uniform varies from \$150 to \$350 for it is designed especially to protect the players from bruises and broken bones. A uniform includes a leather helmet, pads for shoulders, hips, knees and thighs, pants, undershirt and jersey and socks and shoes. Shoes have cleated soles to take a firm grip on the turf.

Organization of Conferences

Many colleges and universities are members of conferences composed of institutions in the same section with about the same football resources and traditional rivalries. The teams belonging to a conference play most of each season's games against other

members of the group and direct their best efforts toward winning the conference championship. The major conferences with dates of organization are as follows:

WESTERN (1926)		B O SEVEN (1907)	
Ill. no a	Minnesota	Colorado	Missouri
Indiana	Northwestern	Iowa State	Nebraska
Iowa	Ohio State	Kansas	Oklahoma
Michigan	Purdue	Kansas State	
Michigan State	Wisconsin		
M IDWEST VALLEY (1907)		SOUTHEASTERN (1933)	
Detroit	Oklahoma A & M	Alabama	Le State
Houston	Tulsa	Auburn	Mississippi
	Wichita	Florida	Missouri State
		Georgia	Tennessee
		Georgia Tech	Tulsa
		Kentucky	Vanderbilt
SOUTHWEST (1915)		MOUNTAIN (SKYLINE) (1937)	
Arkansas	Texas	Baylor	New Mexico
Baylor	Texas A & M	Colorado A & M	Utah
Rice	Texas Christian	Denver	Utah State
Southern Methodist		Montana	Wyoming
PACIFIC COAST (1916)		ATLANTIC COAST (1953)	
California	Southern California	Clemson	North Carolina
(Los Angeles)		Duke	Indiana State
Idaho	Stanford	Maryland	South Carolina
Oregon	Washington	N Carolina	Virginia
Oregon State	Washington State		Wake Forest
SOUTHERN (1922)		Ivy (1954)	
Catholic	Virginia Military Institute	Brown	Harvard
Davidson	Virginia Polytechnic Institute	Columbia	Pennsylvania
Furman	Washington & Jefferson	Cornell	Princeton
Georgia	William and Mary	Dartmouth	Yale

Other well known teams are Army, Marquette, Navy, Pennsylvania State and Pittsburgh, Notre

Dame is another nonconference school that usually has a powerful football team each year.

Because football schedules are planned several years ahead, the outstanding teams of each season often do not play each other. As a result, it is almost impossible to select a true national championship team. Many of the best teams play in the annual New Year's Day "bowl" games. In the Rose Bowl at Pasadena, Calif., the oldest bowl game, a leading team of the Pacific Coast Conference is the home team. Following agreements signed in 1946, 1951, and 1953, the Western Conference, or Big Ten, sends one of its top teams to play in the Rose Bowl. In the South, the leading bowl games are played in the Cotton Bowl, at Dallas, with the Southwest Conference champion the host school; the Sugar Bowl, at New Orleans, with the Southeastern champion the host school; the Orange Bowl, at Miami; the Sun Bowl, at El Paso; and the Gator Bowl, at Jacksonville.

In San Francisco, a game sponsored by the Shriners for charity is played each New Year's Day between two all-star college teams, one from the East and one from the West. The Blue-Gray game at Montgomery, Ala., matches a team of all-stars from the South against a similar team from the North.

Early Ancestors of Football

Football is an ancient sport. A game called *narpaston* was played by the Spartans as early as 500 B.C. In this a ball was kicked, passed, or carried across the opponents' goal line. Strikingly similar to a modern football was the *foliis*, used in Roman games. It was made of leather and inflated

STOPPING A RUNNER ON A MUDDY FIELD



A sculptor might have designed this group of players snapped during a game in the rain. The man in the center is carrying the ball and has driven head first into the enemy line, where two men are pulling him down, while the man at the left is trying to block the hole.

with air, but it evidently was propelled not by foot, but by hand and arm.

A game called *calcio*, a modified form of *harpaston*, enlivened medieval tournaments in Italian cities. The players, 27 on a team, used line and backfield formations not greatly unlike those of football today. Princes, soldiers, and "the noble ladies and the people" cheered for their favorites. A brawl-like kind of football was played in England as early as the 10th

century, and by the 12th became a national problem. The game was making London a bedlam. Besides, it was diverting the yeomen from archery, the sport that fitted them to defend England. Hence football was banned by municipal laws and royal edicts. It was not fully reinstated until the 17th century, when Charles II opened his country to many diversions theretofore prohibited. The sport began to take definite form at boys' schools. Some even drew up rules. These allowed the ball to be kicked, but not carried, toward the goal.

The Father of Our College Game

One November afternoon in the year 1823, something strange happened at Rugby, a famous boys' school. The score was tied in a football battle between two class teams. Dusk was settling. Suddenly a player named Ellis "with a fine disregard for the rules of football as played in his time took the ball in his arms and ran with it" across the goal line. The score was not allowed. But the event made history and began Rugby football, from which the American game is directly descended. A tablet at Rugby commemorates Ellis' exploit.

By 1863 the new game of Rugby had become very popular. Those who clung to the old idea that football should be played by kicking the ball met in London and formed the Football Association. Thereafter this game was known as "Association football," or "soccer," a jumbled abbreviation of the word association.

Football came to America probably with the English colonists who established Jamestown in 1607. An inflated pig bladder commonly served as the ball for early American games. Women played, too, because throwing and passing were more important than kicking.

Late in the 18th century, football of the most primitive type elbowed its way to a prominent place among college diversions. Early in the 19th century, football games were played at Harvard and Yale to determine class supremacy between freshmen and sophomores. The "games" were hardly more than mass rushes and "slug fests." In 1860 authorities at Harvard and Yale ended these brawls, and Harvard students held a mock funeral for "Football Fightum." An important step toward making football a recognized sport was the organization of the Oneida Football Club of Boston in 1862. The founder of this "first organized football club in the United States" was Gerrit Smith Miller.

The First Football Game Between Colleges

The first intercollegiate football game grew out of rivalry between Princeton and Rutgers. On Nov. 6, 1869, football teams from the two schools met in the

first American intercollegiate football game. The contest took place at New Brunswick, N. J., and Rutgers won 6 goals to 4. The game was played with 25 men on a side. A few days later Princeton won at its home field 8 goals to 0. Rivalry between the two colleges became so bitter that school authorities forbade a third and deciding game.

These first Princeton Rutgers games and later contests showed a lack of uniformity in the rules. After the formation of teams at Columbia in 1870 and at Yale in 1872 the four schools held a rules conference at New York City in 1873. They agreed to play their games according to the soccer laws of the London Football Association.

In 1875 Harvard and the McGill University Football Club of Canada introduced the Rugby principle of running with the ball (advancing it by carrying). The two teams played part of one contest under Harvard (soccer) rules and the remainder of the game under the Rugby rules of McGill. Rugby impressed Harvard players so favorably that they decided to abandon what was called the somewhat sleepy type of game then played. Yale, Princeton and Columbia soon followed suit by adopting Rugby rules. By 1876 the right to run with the ball was generally recognized.

Five Builders of Modern Football

Modern football was developed by many capable men. Five who greatly helped to improve the game were Walter Camp (1879-1925) and the coaches Amos Alonzo Stagg (born 1862), Fielding H. Yost (1871-1946), Glenn S. Warner (1871-1954) and Knute Rockne (1888-1931).

Walter Camp is called the father of American football because he is credited with doing more than any other man to improve the intercollegiate game. After starring at Yale for several years he served as adviser of every important rule-making group until his death.

In 1880 he persuaded the rule makers to reduce the number of players on a team from 15 to 11 and to replace scrum or scrummage with scrimmage. In scrim the ball was put into play merely by placing it on the ground between the rival lines and letting the players scramble for the ball. A team was thus never assured of possession of the ball on two consecutive

plays. Scrimmage permitted the offensive team to put the ball into play either by kicking it or snapping it back. A third important change in 1880 was creation of the position of quarterback. He was defined as the 'man who first receives the ball from the snapback.'

In 1882 Camp introduced a rule that a team failing to advance the ball at least 5 yards in three plays or downs must surrender it to the opponents. This is the origin of the present rule that a team must advance the ball at least 10 yards in four downs.

How the Game Was Reorganized

Camp also cooperated with others to redeem the game from brutality. Mass plays, such as the V shaped or wedge formation were causing injuries and deaths. Sometimes a team would lock hands around the man carrying the ball and sweep everyone

before it. Tough characters called rangers were hired as players by some colleges. These tactics disgusted many schools. West Point and Annapolis abandoned the game. President Theodore Roosevelt called football experts to a White House conference in 1905 to see what could be done to prevent death and injury. In 1906 the rule makers revolutionized the game by barring all mass plays and introducing the forward pass, which led to a more open style of play.

The Work of Stagg and Yost

Another Yale graduate who raised the standards of the game was A. A. Stagg, athletic director and football coach at the University of Chicago from 1892 to 1933. In 1896 he helped to organize the Western Conference or Big Ten (Chicago withdrew in 1946 and was replaced by Michigan State in 1949). This group pioneered in setting up and enforcing eligibility rules and amateur standards. Stagg developed many stars including Clarence B. Herschberger, Walter Steffen and Walter Eckersall. Known as the 'Grand Old Man,' he coached football teams for more than 60 years.

A builder of mighty teams was Fielding H. (Hurry-Up) Yost, football coach at the University of Michigan for 25 years. When Yost entered upon his job in 1901 the game was already well established at Michigan. As early as 1873 the school had challenged Cornell and arrangements were made to play at Cleveland 30 men on a side. But the proposed game never took place. Andrew Dickson White, then president of

WHAT EVERY PUNTER DREAMS —A BLOCKED PUNT



Just as the ball left the foot of the kicker (No. 35 with back showing), two opponents had broken through the line, jumped up and blocked the kick. This takes skill and courage but it may decide the game.

Cornell, ruled: "I will not permit 30 men to travel 400 miles merely to agitate a bag of wind." Michigan played its first intercollegiate football game six years later, defeating Racine College.

Yost raised Michigan to power in the football world. His team of 1901, built around a freshman Willie Heston, scored nearly a point for each minute of play. It amassed 550 points in 11 games and kept its oppo-

many of the strongest elevens in the nation and to gain in some seasons the honorary title, "national champion." His teams won every game in the seasons 1919, 1920, 1924, 1929, and 1930.

The eleven of 1924 traveled 10,500 miles and played in seven states. It climaxed the season by defeating "Pop" Warner's powerful Stanford team, 27 to 10, at the Rose Bowl game Jan. 1, 1925. The success of the 1924 team was due largely to the brilliant play of the backfield, known as the "Four Horsemen." They were Harry Stuhldreher, James H. ("Jim") Crowley, Elmer Layden, and Donald ("Don") Miller. The first three later gained fame as coaches.

Coaches and the "Platoon" System

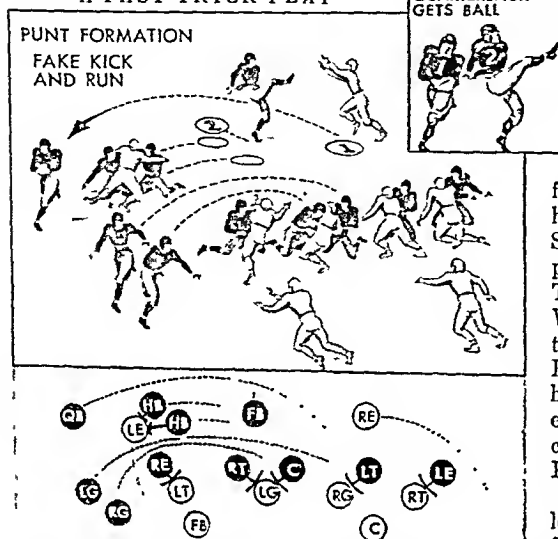
Another master of strategy was Robert C. (Bob) Zuppke of the University of Illinois. He gained fame chiefly for the running attack he built around his halfback, Harold E. (Red) Grange, 1923-25. Clark Shaughnessy at Stanford and George Halas of the professionals won acclaim for perfecting the powerful T-formation offense about 1940. After the second World War other coaches molded consistently good teams. Such men were Frank Leahy of Notre Dame, Earl Blaik of Army, Charles (Bud) Wilkinson of Oklahoma, Gen. Robert Neyland of Tennessee, and Clarence (Biggie) Munn of Michigan State. Famous coaches and players are honored in football's Hall of Fame established at New Brunswick, N. J., in 1949.

From 1941 through 1952 one of the features of college football was the "two-platoon" system of play. A free substitution rule enabled coaches to use one platoon of players on defense and another on offense. In 1953, however, the free substitution rule was killed. A player who left the game in the first and third quarters could not return to action in those periods. This rule was changed in 1955. Under the 1955 rule the players who start each quarter can leave and then return *once* in that same quarter.

The Popular Professional Game

Professional ("pro") football, so called because its players receive pay, started at Latrobe, Pa., in 1895. The game caught on slowly at first but after 1920 it spread all over the country. Some of the leading pioneers were Dr. Harry A. March, often called the

A FAST TRICK PLAY



Here player No. 2, the fullback on the team with the black jersey, has pretended to punt, but instead he tossed the ball under his arm to No. 1, the quarterback who circled back of him. No. 1 now dashes around his right end, protected by two halfbacks and two guards. The panel at the bottom shows how the teams lined up and the blocking assignments of each man.

nents scoreless. Yost continued to develop "point-a-minute" teams for the next four years. After 1921, he served as athletic director and built a model program of intramural sports.

Two Master Minds of the Gridiron

More spectacular than either Stagg or Yost was Glenn S. ("Pop") Warner, the coach who took over the football team at the Carlisle Indian School in 1899. A graduate of Cornell, he coached football teams for 45 years. At Carlisle he introduced the unbalanced line with single and double wingbacks to create what is called the "Warner system" of play. There too he developed outstanding teams, notably those built around Jim Thorpe, an Indian, whose speed, power, and skill made him an all-American star.

A great teacher and leader was Knute Rockne, head coach at Notre Dame University from 1918 until his death in an airplane accident in 1931. While a student at Notre Dame, Rockne played on the team that overwhelmed West Point (Army) in 1913 by throwing forward passes from all angles of the field. As coach at Notre Dame, Rockne developed the forward pass and the shift to such a degree that many other coaches adopted his style of play and called it the "Rockne system." His leadership inspired his teams to beat

THE NATIONAL FOOTBALL LEAGUE

Eastern Division		Western Division	
Chicago	Cardinals	Baltimore	Colts
Cleveland	Browns	Chicago	Bears
New York	Giants	Detroit	Lions
Philadelphia	Eagles	Green Bay	Packers
Pittsburgh	Steelers	Los Angeles	Rams
Washington	Redskins	San Francisco	49ers

"Father of Professional Football," Joseph F. Carr, Tim Mara, Earl ("Curly") Lambeau, and George Halas.

The National Football League, formed in 1921, led the way in establishing the pro game as a major sport in America. The All-America Conference played the 1946-49 seasons. The Cleveland Browns

won all four championships. In December 1919 this conference merged with the National League. The eastern and western divisions on leaders meet in an annual play-off game for the league championship.

Professional football employs mostly ex-college stars. The teams select their prospective players in an annual draft of college seniors with the lowest ranking teams choosing first. The players are then signed to contracts which may call for as much as \$20,000 a year but usually much less.

In the 1930s pro football became popular in Canada. Many players in the Canadian leagues are American ex-college stars. In the Canadian game the field is longer and wider and each team has 12 men—five backs and seven linemen. To make ten yards there are only three downs, no downfield blocking and no time out except for injury. The ball is not dead in the end zone if the receiving team fails to run the ball from the zone; the kicking team gets one point, a *rouge*.

How to Watch a Football Game

Unless a spectator knows what to look for in the game he misses the finer points and often some of the important action. The typical fan watches only the ball carrier. He does not notice how blockers make long runs possible. The expert spectator however watches the game as the coach does. He notices every offensive and defensive formation and he studies the work of each individual player.

Here are some tips for watching a game. A ground (running) play can go only in three directions—around

the ends through the middle of the line or outside the defensive tackle (off tackle). Watch the offensive linemen for a while. They are the key blockers who foretell the type and direction of a play. If the play is off tackle or around end the linemen will block from the outside toward the center. If the play is to go down the middle they will block from the inside toward the sidelines. Notice also

how the center guards and tackles stand fast only if the play is to be a forward pass.

If the linemen indicate that a pass is coming up forget the passer and try to pick out probable receivers. Notice how an end will streak down the field feinting to shake off secondary defenders. If he catches the pass and is hemmed in by enemy tacklers watch how he will maneuver while friendly blockers form in front of him to clear the way.

Usually the defensive team guards its goal line in four separate waves arranged in depth—the line

the line backers, the secondary and the safety men. It is the duty of the line to stop the ball carrier at the line of scrimmage or to throw him for a loss if possible. To avoid being tackled out of position a good lineman usually charges straight ahead. If the opposing team passes frequently the linemen try to rush the passer to hurry him or deflect his aim.

The line backers are the most interesting defensive men to watch. They act as the quarterbacks of the defense, analyzing where the next play will go and then calling the signal to organize a certain defensive formation. Line backers must be prepared to run forward and close a hole in their line or drop back to guard against short passes.

The secondary does most of the defensive work against long passes. But these men also aid the line-backers in stopping an opposing ball carrier who has broken loose. Of all the defensive players the safety man should be the most deadly tackler. He occupies the last defensive outpost between the opposing team and the goal. If he fails to stop the ball carrier it usually means a touchdown for the other team.

Three Variations of Football

A game called six man football invented by Stephen Epler and first played at Hebron, Neb. in the fall of 1934 has become popular. It differs from intercollegiate football as follows: (1) six men—a center, two ends and three backs—constitute a team; (2) the playing field is 80 by 40 yards; (3) quarters are only 10 minutes long; (4) a field goal counts 4 points.

WATCH THE GAME AS A COACH DOES



This back charging line is open on a big hole for the ball carrier. One backfield man runs ahead to act as late defense. Not so long well a two-on-one back takes out a defense tackle.

(5) all running plays must originate from a lateral pass behind the line of scrimmage and (6) all members of the team are eligible to receive a pass.

A popular playground sport is touch football, so called because *touching* or tagging is substituted for tackling. This rule encourages an open style of play with the emphasis on passing. Any number may play but a team usually has from 7 to 12 members. The attacking team has four downs in which to advance the ball 20 yards. A game is commonly divided into two 12-minute periods with a 4 minute intermission.

Association football (soccer) still holds to the pre-Rugby style of game and uses a round ball. The ball, after being put in play, may not be carried or touched by the hands or arms, except by the goalkeeper. It is advanced chiefly by kicking and dribbling it with the feet. A goal is scored when the ball is kicked *underneath* the crossbar of the goal posts, which are 8 yards apart and 8 feet high. Eleven men play on a side, and the field is from 100 to 120 yards long and from 55 to 75 yards wide. Soccer is played by many schools in America and Europe. It has perhaps even greater popularity among nonschool teams, such as those affiliated with the United States Football Association, incorporated in 1913. This unit also sponsors international soccer matches, which are among the most brilliant of sports events.

Rugby, Reigning Game in the British Isles

Rugby, the parent of intercollegiate football, is little played in the United States. In the British Isles, however, it is so important that disputes over rules are taken before an international board composed of representatives from the Rugby Unions of England, Scotland, Wales, and Ireland. Rugby resembles the American game in that the ball is oval and may be advanced by carrying, passing, and kicking. It differs notably in having 15 men to a team and in placing a higher premium on field goals.

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FORD, HENRY (1863-1947). In 1896, a "horseless buggy" chugged along Detroit's streets. Crowds gathered whenever it appeared. Terrified horses ran away at its approach. The police tried to curb this nuisance by forcing its driver, Henry Ford, to procure a license. That car was the first of many millions produced by

the genius who was destined to make more automobiles than any other man in the world.

Henry Ford was born on a 40-acre farm close to Dearborn, Mich. His mother died when he was 12. He helped on the farm in summer, and in winter attended a one-room school. Watches and clocks fascinated the boy, and he went about the countryside doing repair work without pay, merely for the chance to tinker with machinery. Years later Ford remarked: "My toys were all tools; they still are."

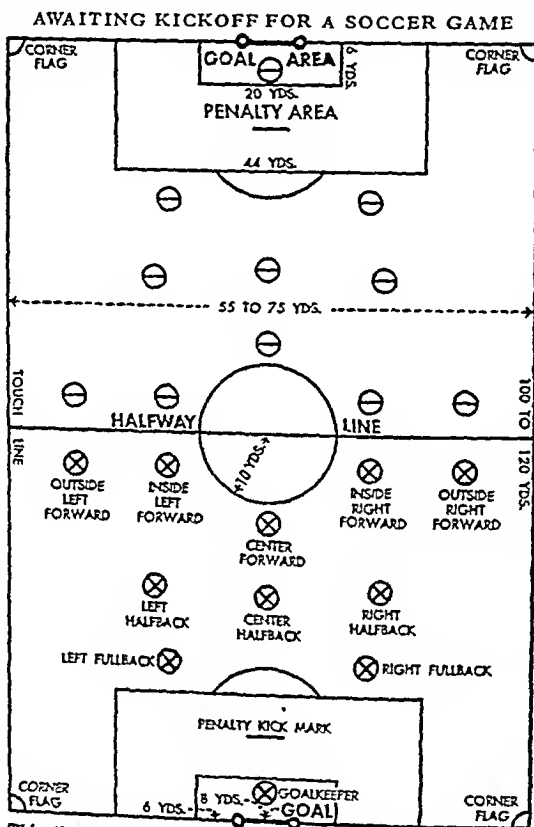
At 16, Ford walked to Detroit and apprenticed himself to a mechanic for \$2.50 a week. His board was \$3.50, so he worked four hours every night for a watchmaker for \$2 a week. Later he worked in an engine shop and set up steam engines used on farms. In 1884 he took charge of a 40-acre farm his father gave him, married, and seemed "settled down." But after two years of farming he went back to Detroit and worked as night engineer for the Detroit Edison Company.

Gasoline engines were just becoming popular and they fascinated the man as watches had fascinated the boy. Ford built his first car in a little shed behind his home. Its two-cylinder engine over the rear axle developed four horsepower; a single seat fitted in a box-

like body; the car had an electric bell for a horn, and a steering lever instead of a wheel.

In 1899, Ford helped organize the Detroit Automobile Company, which built cars only to order. Ford wanted to build them in great quantities, at a price within the reach of many, as Ingersoll had done with watches. His partners objected, and Ford finally withdrew from the organization.

In 1903, he organized his own Ford Motor Company. The authorized capital was \$100,000, but only \$28,000 was raised in cash. The cash came from 11 other stockholders, some of them neighbors whom Ford had kept awake by the sputtering motors of his first cars as he worked far into the night. One investor, who put \$2,500 into Ford's venture (only \$1,000 of it in cash), drew more than \$5,000,000 in dividends, and received more than \$30,000,000 when he sold his holdings to Ford in 1919. The company's assets, now



This diagram of a soccer field shows how the teams line up for the kickoff at the start of each period and after every goal.

largely controlled by the family of Ford's son Edsel (1893-1943) have been valued at \$315,000,000.

The early automobile manufacturers merely bought automobile parts and then assembled the cars. Ford's aim was to make every part that went into his cars. He acquired iron and coal mines, forests, mills and factories to produce and shape his steel and alloys, his fuel, wood, glass and leather. He built up railroad and steamship lines and an airplane freight service in order to transport his products.

Mass production was Ford's main idea, and he replaced men with machines wherever possible. Each man was given only one task, which he did over and over until it became automatic. Conveyers brought the job to the man instead of having the man waste time going to the job. To cut shipping costs, parts instead of cars were shipped from the main plants in the Detroit area, and the parts assembled into cars at branch plants in the United States, Canada, and in overseas countries.

In addition to his business acumen and inventive genius, Ford won fame as a philanthropist and pacifist. He established an eight-hour day's minimum wage of \$3 daily (later raised to \$6) and a five-day week. He built a hospital in Detroit with fixed rates for service and doctors and nurses on salary. He created the Edison Institute, which includes Greenfield Village and the Edison Institute Museum and trade schools. In the Village, Independence Hall, Edison's early laboratory and other famous old buildings are reproduced. During the first World War, Ford chartered a peace ship and headed a party to Norway hoping to induce the neutral nations of Europe to end the war, but the venture failed. During the second World War, he built bombers, guns, and motorized equipment at his Willow Run, Detroit, and River Rouge plants.

In 1945, Ford yielded the presidency of the Ford Motor Company to his 23-year-old grandson, Henry Ford II. Ford died April 7, 1947, at the age of 83. Most of his personal estate, valued at about \$280,000,000, was left to the Ford Foundation, one of the world's largest public trusts.

FOREIGN EXCHANGE When citizens of different countries trade with each other, they seldom pay cash for what they buy. Usually each buyer arranges with a bank to pay whatever he owes in the currency of

AT THE BIRTHPLACE OF LIGHT IN FORD'S VILLAGE



At the left, President Hoover, Henry Ford and Thomas Edison (seated) are shown as they appeared in Ford's reconstruction of Edison's laboratory in Greenfield, Mich., at the 1929 celebration of the invention of electric light. At the right is a reconstructed church in Greenfield.



the creditor's country with a bill of exchange (see Credit). For example, suppose Chase, an American, has sold \$1,000 worth of goods to Smith, an Englishman, while Blake, another American, has bought the same amount from Jones, another Englishman. In-

stead of each debtor sending money across the ocean, Blake buys Chase a claim upon Smith, paying an American money. Chase then sends the claim to Jones, and Jones collects from Smith in English money.

Such transactions are conducted through banks and dealers in foreign bills and exchange. Before the first World War, charges for this service were based in part upon the balance of trade at the moment (see International Trade). If Frenchmen owed Americans more than Americans owed Frenchmen, the French paid more for bills collectible in American money until the price equaled the cost of shipping gold. Then exchange was

said to be at the gold point, and France shipped gold until the exchange each way became equal.

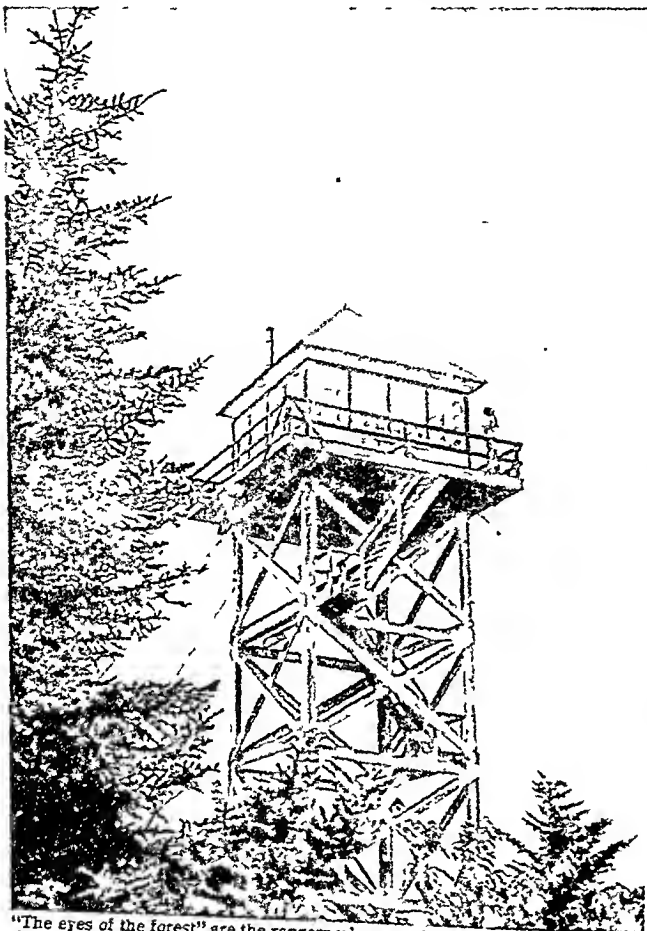
During and after the first World War, most nations feared that uncontrolled foreign exchange would deplete their gold and devalue their money (see Money). Most governments restricted export of gold. Some substituted government barter of goods for private money payments in foreign trade. Many nations used a stabilization fund to buy or sell foreign money to peg or hold the value of their money in relation to that of a major power. Absolute world-wide control was imposed during the second World War. Currency restrictions after the war led the Organization for European Economic Co-operation (OEEC) to establish the European Payments Union (EPU) in 1950. Trade between countries of Western Europe and the associated monetary areas was made easier by making payments through a central pool.

HENRY FORD



Ford was the master of mass production at the automobile industry.

The LIFE-GIVING WOODLANDS and Their FOES



"The eyes of the forest" are the rangers who man the lookout towers in the national and state forests. They are trained to detect and locate a fire before it gets out of control, and they send fire fighters to the area immediately.

FORESTS AND FOREST PROTECTION. Next to soil and water the forest is man's most valuable natural resource. From the forest comes wood for houses, furniture, fuel, railroad ties, telephone poles, and countless other products. The paper for books, magazines, and newspapers is made of wood pulp. Turpentine, tar, and rosin (naval stores), tannin, fruits, nuts, dyes, and crude drugs are among the forest's gifts.

A priceless service which people seldom think about is the protection a forest gives those other two life-giving resources, soil and water. Down on the forest floor is a thick layer of leaves, pine needles, and twigs. You know how soft and springy this forest floor feels underfoot. Press some of the top material in your hands. It is moist and spongy. If you dig deeper you will find a dark mass of decaying plant matter, earthworms, insects both dead and alive, all mixed with earth. This is called *humus*. It soaks up rain and snow like a blotter. Some of the mois-

ture is used by the trees to support their own life. Some of it evaporates. The rest sinks into the ground where it reaches a level called the *water table*. The water table is an underground storage reservoir. Plant roots reach into it. Springs and streams issue from it. It is the source of most of our great rivers.

Forests Protect Water Sources

Where forests have been cut down and the humus destroyed, rain falls on hard bare ground. The water rushes downhill, carrying precious topsoil with it. Streams and rivers rise rapidly to flood height and as quickly dwindle away. In a long rainless period the smaller streams may dry up. By holding water in the ground, therefore, forests serve the very important function of keeping the flow of streams constant and continuous throughout the year. The United States Forest Service estimates that one half of our forest area exercises a major influence on stream flow. Another quarter of the area has a moderate influence. The area of major influence, however, feeds streams that flow through nearly every part of the country. Most of our population therefore, benefits directly or indirectly from forest-protected waters.

Forests also prevent soil erosion. The roots of trees hold soil in place like countless tiny dams. The crowns of the trees break the force of falling rains and prevent "splash erosion," or the direct battering of soil by rain. Woodland streams are clear and sparkling because they are not washing away soil. Forested areas also are more humid and have more showers than the open country, because the leaves of the trees breathe moisture into the air by the process of transpiration.

Forests shelter wildlife. Birds, deer, and valuable fur-bearing animals live in the forests, in its streams, and on its borders.

The recreational value of forests increases in importance as cities grow larger and more crowded. People enjoy camping out and picnicking in the woods. Even a Sunday afternoon drive through the woods is refreshing. Such forests as New York's wooded Long Island and Westchester parks, and the Cook County forest preserves that border Chicago, provide rest and recreation for millions of people. Indeed, the word forest comes from the Latin *foris*, meaning "out of doors."

Forests, therefore, have four very important uses. They provide wood products essential to civilization. They prevent floods and erosion, regulate streams, and protect water sources. They shelter wildlife.

They provide recreation for city dwellers

Forests consist of conifers or trees bearing cones and needles also known as soft woods and deciduous broad leaved trees also known as hard woods. Mixed forests with trees of both kinds are common (See also Trees)

Life Struggle in the Forest

Life in the forest is a battle for the survival of the fittest. Each tree fights for its right to live. On every side are other trees crowding toward the light and air necessary for growth. As they grow their crowns fill the space overhead with a dense canopy of leaves. The lower branches deprived of sunlight die and drop off. The typical forest tree has a tall bare trunk top branches stretching upward instead of outward and a narrow crown. This type of tree makes the best lumber. Trees that grow in the open have broad crowns and wide-spreading limbs that branch out from the trunk nearer the ground.

Wherever sunlight filters down to the forest floor seedlings and sprouts from old stumps fill all the

A SPARKLING STREAM IN THE TETONS



Such a stream as this in the Grand Teton National Park may be the source of a great river. Forests as a most important factor in protecting the headwaters of rivers.

space. Some outstrip their companions in growth and use all the light available. These the forester calls *dominants*. The others become twisted and stunted or they die.

When a beech-maple-hemlock forest is cut down or destroyed by fire and the area is left unplanted it is not replaced at once by a forest of the same type. An entirely new association of plants appears in the area. Most of these plants or their seedlings have to grow in direct sunlight. The new association may be replaced by several others before the area after many years gets back to the original beech-maple-hemlock forest. Thereafter the growth is able to maintain itself indefinitely. It is not disturbed partly because the seedlings of these trees are able to develop in the shade of the mature trees.

Such a stabilized unchanging forest is known as a *climax forest*. (See also Ecology section III)

Fire the Greatest Enemy

The forest has many enemies. One of the worst is fire. Nine out of ten forest fires are caused by

WILDLIFE AND RECREATION—TWO VALUES OF THE FOREST



This deer (left) is at home on the edge of the forest, where he browses for food. He dashes in to its depths for safety. Campers (right) vacation in the woods. Many common trees find that their forests are big business. Licenses to hunt and fish are a source of revenue and people find employment providing hunters, fishermen and campers with supplies and guide service.



human carelessness. Neglected campfires, cigarettes flipped out of passing automobiles, burning debris from logging operations, brush fires, sparks from railroad locomotives—these are the chief causes of fires which destroy millions of acres of forests every year. A few fires are caused by lightning.

Most terrifying is the crown fire that sweeps across the leafy tops of trees. Such a fire takes a high toll in human and animal life. One of the worst in history was the Peshtigo, Wis., fire of October 1871. A total of 1,280,000 acres was burned; homes, towns, settlements were destroyed; and 1,500 people lost their lives.

Slow-burning ground fires are less spectacular, but they are almost as destructive. They kill seedlings and destroy ground cover and humus. No new trees grow in such an area, the fertility of the soil is ruined, and the ground is laid bare to erosion. The bases of the big trees are injured, exposing the wood to insects and fungus diseases. If the fires continue, the whole forest can be lost through disease and poor soil conditions.

A RAGING CROWN FIRE



Started by human carelessness, this fire in Oregon destroyed in a few hours a forest that took hundreds of years to grow. Swept by high winds, a crown fire overtakes animals and young birds. Fire fighters and others may lose their lives.

Keep America Green campaigns are teaching people the importance of preventing fires from starting. Begun in Washington in 1940, this movement has spread to most of the forested states. It is a co-operative educational program, conducted by citizens in their own localities under the leadership of the wood-products industries. Arbor Day is also a valuable educational movement (see Arbor Day).

The Men Who Fight Fires

"The eyes of the forest" are the men in the lookout towers scattered through the national and state forests. In a glass-enclosed room on top of the tower the lookout can see over the treetops. Before him is a map of the area. When he spots a wisp of smoke he locates it by means of an instrument called an alidade. Meanwhile another lookout, miles away, has sighted the fire from another angle. Both men immediately telephone the nearest range station. These two calculations fix the fire's exact location.

A few minutes after the fire has been located, the fighters are on their way. Their work is directed from the ranger station. The ranger has maps of the entire forest showing its roads, trails, and footpaths. He knows where the streams and ponds are and whether or not there is enough water in them to supply the pumps. He has weather reports on wind directions and possible rain. Two-way radio installations keep him in touch with the fighters, and a patrol plane radios further information.

If the fire is in a remote area that cannot be reached by road or trail, "smoke jumpers" are dropped from airplanes. These are often young men who have had experience during the war as paratroopers. They parachute into the fire area with chemicals and hand pumps. Additional fire-fighting equipment is dropped to them.

If the fire can be reached by road, a truck equipped with water tanks and power pumps is dispatched. Truck loads of men follow with extra tools, food, camp equipment, and a first-aid tent. These are the "smoke eaters," who battle the fire from the ground. A fire may be too large to extinguish by hand and power water pumps. Then the "smoke eaters" try to isolate it and prevent it from jumping and spreading by clearing out the underbrush along its perimeter. They once relied mainly on axes, shovels, and other hand tools. Although there is still need for handwork, specially designed plows and bulldozers are now used to a great extent for this difficult and dangerous work.

Other Enemies of the Forest

Insects cause enormous losses. Conifers are more likely to suffer than broad-leaf trees. The western pine beetle in the ponderosa-pine forests and the southern pine beetle attack the trees in swarms and burrow into the bark. There the females lay their eggs. After the eggs hatch, the larvae bore galleries which cut off the flow of sap and kill the trees. The gipsy moth in the oaks and other broad-leaf trees, the tent caterpillar, spruce budworm, and tussock moth cause great losses. Deadly fungus diseases include the chestnut blight, white-pine blister rust, and oak wilt.

THE GUARDIANS OF OUR FORESTS



The Forest Pest Control Act of 1947 authorizes the United States Forest Service to cooperate with the states and private landowners in controlling insects and fungus diseases on non-federal lands. Under this act a tussock moth infestation covering 413,000 acres was wiped out in 1947 by spraying DDT from airplanes. In Oregon 250,000 acres of Douglas fir forest were dusted with insecticides by airplane in 1949 to control spruce budworm. In the same year Massachusetts sprayed 229,000 acres of Cape Cod woodlands infested with the gypsy moth.

Animals grazing in the woods destroy seedlings and ground cover so that new trees do not grow. They injure mature trees. Their hooves pack down the ground and reduce its ability to absorb water. The Taylor Grazing Act of 1934 permits the Federal government to regulate grazing on public land such as the national forests. Farmers also are becoming aware of the damage their livestock may do.

Good Forestry Today

With the disappearance of the virgin forests people have learned that they cannot mine trees as they would coal. Trees must be treated like any other crop—harvested and replaced year after year. The wise owner of timberlands uses logging methods that assure him a sustained yield—that is a balance between growth and cutting of timber. Two logging methods are common.

Selective logging means the removal of mature trees. A trained forester marks the trees to be taken out and they are cut with a minimum of waste and damage to surrounding trees. With more space and sunshine the remaining trees grow faster. Seedlings develop

better with more light and less crowding. Even wild life benefits when a forest is thinned for most birds and animals prefer so-called edges or open spaces with dense woods nearby for escape.

Block logging is the second method of cutting. Patches or blocks of seed trees are left uncut. With in ten years wind borne seeds from the seed blocks restock the cutover land. Once the seedlings have become established the logger returns and cuts down the seed block.

Where fire and destructive timber operations have left bare areas that will not reseed naturally young trees are planted by hand or by mechanical tree planters. The trees come from nurseries where the kinds that grow best in each state or region are started from seeds.

Farm Forestry

Privately owned forests supply 90 per cent of the nation's wood products and three fourths of these forests are in farm wood lots averaging only 62 acres. Today the high price of lumber makes it profitable for the farmer to grow trees as a crop. Farmers can obtain seedling trees and technical advice from the Federal government. The

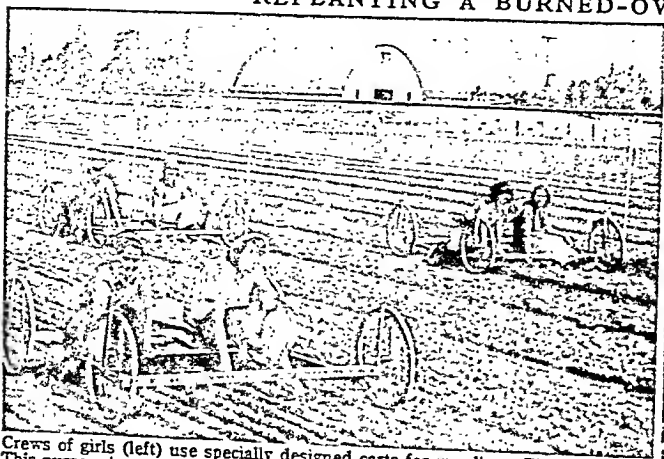


In a tower high above the trees a lookout (1) locates a wisp of smoke with the instrument before him, called an alidade. If the area cannot be reached by road instrument jumper (2) is dropped by parachute. Smoke eaters (3) are the smoke fighters on the ground. Whenever possible they use specially designed fire-line bulldozers to cut away underbrush and isolate the fire.

state forestry department and the extension service of the state agricultural college. Fire protection is also available in most forested areas on a cooperative basis.

Federal aid to private landowners is authorized by the Clarke-McNary Act of 1924 and by the Norris-Dowey Cooperative Farm Forestry Act of 1937. Trained foresters work with farmers and sawmill operators on individual forest-management problems and give technical advice on the utilization and marketing of wood products.

REPLANTING A BURNED-OVER FOREST



Crews of girls (left) use specially designed carts for weeding. The trees are grown from seed at the Nisqually, Wash., nursery. This nursery is operated by the forest industries of the state. When an area is so badly cut over or burned that it will not reseed naturally, young trees are planted by hand (right). On level ground seedlings can be planted much faster by machinery.

Some industries, such as paper mills, provide farmers with seedlings and technical help in return for the right to harvest the timber.

The Tree Farm movement, like the Keep America Green campaign, is an educational program sponsored by the forest industries. Whenever a farmer agrees to follow the rules of good forest management his acres are officially listed as a Tree Farm.

The American Forest Products Industries Association awards scholarships to 4-H Club members for achievements in the use of farm woodland as a source of income. Club members plant seedlings on eroded land and steep hillsides. They raise Christmas trees, cut fence posts and firewood from scrub trees on their acres, and replant for the future.

World Extent of Forests

Forests were once abundant all over the world. Through the centuries vast areas have been destroyed

by man, fire, and disease. Europe now has only one third of its original forest lands. In northern Scandinavia about 50 per cent of this woodland still remains, but in southern Europe from 80 to 90 per cent of the original growth is gone. China's great forests were described by Marco Polo in his book about his travels in the Far East in the 13th century. They were cut down and burned without a thought for the future. Then heavy rains washed away the fertile topsoil. Millions of acres of barren waste replaced the priceless forests and the fruitful soil. As a result, China year after year is harassed by famine and flood.

The most complete survey of world forest resources was published in 1948 by the Food and Agriculture Organization (FAO) of the United Nations. According to this report, the total forested area of the world is 15.4 million square miles, or 9.8 billion acres.

BEFORE AND AFTER NATURAL RESEEDING



On the left is a hillside in Washington where a heavy stand of virgin Douglas fir was logged. But a block of mature trees, not visible in this view, was left standing. Ten years later (right) the hill was covered with healthy young firs. Protected from fire, it was replanted by wind-blown seeds from the standing block. Notice the lookout tower on the hilltop.

Almost one third of the area is unproductive—that is it does not produce trees of commercial size and quality. Of the productive area 36 per cent are softwoods (conifers) and 64 per cent are hardwoods (broad leaves). A little more than half of the productive area is accessible; the remainder is in remote parts of the world not yet opened up to modern transportation.

Softwoods are preferred for industrial uses. Since only 36 per cent of the total productive forests are softwoods and only 58 per cent of the softwoods are accessible, it is plain that the softwood forest area is inadequate for the world's lumber needs. Brazil, Canada, the United States, and Russia have the largest areas of productive forested land in the world.

Forests of the United States and Canada

In the United States forests originally covered 873 million acres, or 42 per cent of the land area. The entire country east of the Great Plains was covered with a practically unbroken stretch of magnificent trees. When the settlers first came to America they had to cut down and burn the forests to clear the land for farms and settlements. As cities grew the demand for lumber increased.

Wooded lands now occupy nearly one third of the United States, or about 624 million acres. Most of this acreage is so-called second growth—that is, trees that have grown since the original or virgin forest was cut down. Only 44,618,000 acres of the virgin forest remain, most of which is in the Pacific coast states of Oregon and Washington. (See also Conservation.)

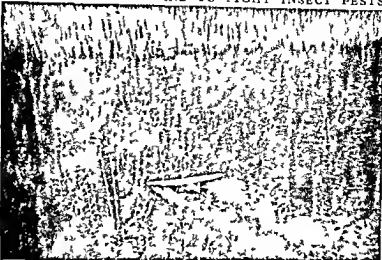
Of the total forest area, 461 million acres are suited to the production of commercial timber. The remaining 163 million acres are classed as unproductive. These lands are better suited to tree-growing than to growing crops, however, and are valuable in protecting watersheds.

Canada's forests cover 836½ million acres, exclusive of Labrador (Newfoundland), whose vast forest resources have never been estimated. About 306 million acres are unproductive. The remaining 530½ million acres are capable of producing continuous crops of trees. A large part of the productive area can not be developed until roads and railroads are built.

Forest Regions of the United States

The United States has six forest regions (for map see United States). The northern forest of mixed conifers and hardwoods extends from New England

SPRAYING BY AIRPLANE TO FIGHT INSECT PESTS



An airplane is spraying DDT over an Idaho forest to destroy the Douglas fir tussock moth. Such large-scale spraying is an expensive operation. It is done cooperatively by the Federal and state governments and private landowners. Millions of trees are saved in this way.

westward across New York and the upper lake states to the Great Plains and southward from New York along the Appalachian to northern Georgia. The white pines of this area supported the lumber industry from colonial times to the beginning of the 20th century. The original white-pine forests have almost disappeared, and only a small portion of hemlock and spruce remains. Most of the virgin hardwood timber is gone from the southern Appalachians, but there are large areas of second growth trees and land suitable for planting. Yellow poplar, oak, maple, birch, and beech are among the valuable hardwoods.

The central hardwood region occupies the eastern slopes of the Appalachians, the Middle West, and the Southwest through eastern Oklahoma and Texas. Three-fourths of the commercial timber in this area is in farm wood lots of 10 to 40 acres. Large tracts of continuous forests are found only in hilly sections unsuited to farming, as in the Ozark Plateau. A few scattered virgin stands remain, but most of the area suffers from cutting of the best trees from fires and from heavy pasturing of livestock in the woodlands.

The southern forest region extends through the South Atlantic and Gulf states and most of Florida. Most important are the pines known in the lumber industry as southern yellow pine. They are now the chief product of the eastern and central lumber market. The tropical forests of extreme southern Florida and Texas have little commercial importance.

West of the treeless plains are the conifer forests of the Rocky Mountain region. They are especially important in protecting the sources of water used for irrigation and city water supplies and are more valuable for this purpose than for lumbering.

The Pacific coast has some of the heaviest stands of timber in the world. Here are the last great

THE SIGN OF A GOOD FOREST



The sign reads "North Star Council, Boy Scouts of America, owner Tree Farm, certified by Minnesota Dept. of Conservation, Division of Forestry, in Co-operation with Minnesota Forest Industries and Keep Minnesota Green Com." The sign is given only to farms pledged to scientific forestry.

virgin forests—the giant Douglas firs and redwoods which required hundreds of years to reach their present enormous size. The three Pacific coast states of Washington, Oregon, and California furnish about 40 per cent of the nation's lumber production. British Columbia, in the same region, furnishes 44 per cent of Canada's lumber (see Lumber).

Forest Conservation

Long ago men began to realize the importance of their forests, and steps were taken to prevent their destruction. Throughout Europe, especially in Ger-

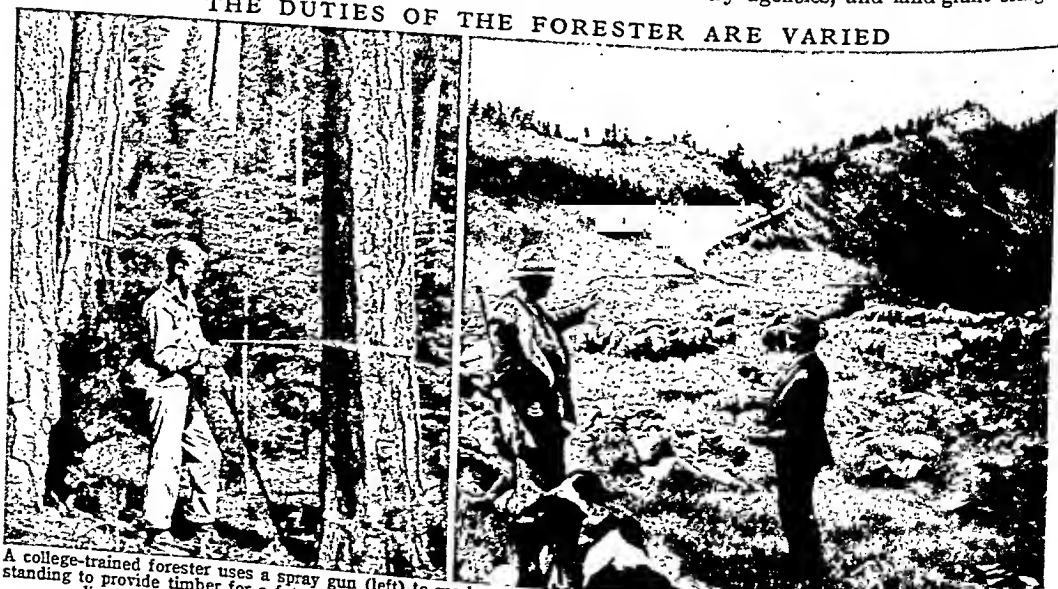
many, forestry has been a science (see Black Forest, Germany).

In the United States the supply of timber seemed inexhaustible. Farsighted men, however, in 1875 founded the American Forestry Association to make people aware of the need for conservation measures. This organization was largely responsible for the creation of the national forest system and the United States Forest Service. Its educational work and the monthly magazine *American Forests* are supported by membership fees and voluntary contributions. The headquarters are in Washington, D.C.

In 1891 Congress empowered the president to create forest reserves, now called national forests. President Harrison then established the Yellowstone Park Timberland Reserve. This was the first of the national forests, which now cover some 180 million acres.

In 1911 the Weeks Act provided for acquiring forest lands on the watersheds of navigable streams. Under this law, large tracts were acquired in the Appalachian and the White Mountains, in the Middle West, and in Oregon. The Clarke-McNary Act of 1924 provided for federal coöperation with the states and private landowners in fire protection. It also authorized the distribution of trees for planting on forest lands owned by farmers, whether or not they were on watersheds of navigable streams. The McSweeney-McNary Act of 1928 expanded forest research activities and the McNary-Woodruff law enlarged the purposes for which national forests could be created. The Forest Pest Control Act of 1947 and the Taylor Grazing Act of 1934, already mentioned, are designed to control two serious enemies of the forests. The Norris-Doxey act of 1937 expanded coöperation with farmers, state-forestry agencies, and land-grant colleges.

THE DUTIES OF THE FORESTER ARE VARIED



A college-trained forester uses a spray gun (left) to mark a mature ponderosa pine for cutting. Trees not marked will remain standing to provide timber for a future harvest. This is known as selective logging. A sheepherder and a forester (right) are discussing range conditions in one of the national forests. Foresters are responsible for preventing overgrazing.

The Civilian Conservation Corps which operated from 1933 to 1942 did useful forestry work. A large proportion of its 300 000 members were in forest projects. They planted trees on public and private lands and they built roads, firebreaks and fire towers. They reduced fire hazards along many miles of road and fought fires.

The Prairie States Forestry Project, better known as the national shelterbelt, was launched in 1935. It was a system of windbreaks to reduce wind erosion and to conserve soil moisture on the Great Plains. In seven years 200 million trees and shrubs were planted in 17 000 miles of field windbreaks. The shelterbelt planting program was transferred to the Soil Conservation Service in 1942.

National Forests and Forest Service

The United States Forest Service, created in 1905 from an earlier bureau, is a branch of the federal Department of Agriculture. It administers the national forests. It conducts research at the Great Forest Products Laboratory in Madison, Wis., and at 12 experiment stations. This research covers the entire field of forestry: management of rangelands, wildlife management, harvesting of timber and development of new uses for wood products. The service also cooperates with the states, with the land grant colleges and with private owners in the application of sound forest-management practices, fire protection, distribution of planting stock for windbreaks and farm wood lands, and marketing of wood products.

The national forests are grouped for administrative purposes into ten districts, each under the direction of a regional forester. Each forest is managed by a forest supervisor who is responsible to the regional forester of his district. Each forest in turn is divided into several ranger districts. The rangers direct timber sales, supervise grazing of livestock, direct the construction of roads, trails, telephone lines, and lookout stations. Above all, they protect their districts from fire. On the ranger rests much of the responsibility for the successful management of the forest.

In Canada, the Forestry Branch of the Department of Resources and Development has the same responsibilities as the United States Forest Service. It operates five experiment stations. Both the federal and the provincial governments retain ownership of timberlands and control cutting operations by issuing licenses to private lumber interests.

State and Community Forests

State forests cover many millions of acres. Michigan, New York, Minnesota, and Washington have the largest acreage. Much of the land was acquired by purchase programs. Some areas of cutover and burned over land were acquired through failure of the owners to pay their taxes. During the years of economic depression in the 1930's, the Resettlement Administration bought tracts of submarginal farm land and took them out of crop production. Many of these lands are now reforested. Although they are federally owned, they are leased to the states and

managed as a part of the state forest systems. (A list of national and state forests will be found with the entry **Forests** in the **FACT-INDEX**.)

Community forests have been owned by many New England towns since colonial days. Elsewhere in the country they are comparatively new. By 1950 there were more than 3 100 community forests. The states of Wisconsin, Michigan, and New York are the leaders in this movement. Many schools or school districts have acquired forests to serve as outdoor laboratories for the study of biology and conservation. Cities often buy large areas to protect the sources of their municipal water supplies. New York, Los Angeles, and Seattle are outstanding examples of cities that own the forested watersheds from which the drinking water comes.

FORGET ME NOT. Centuries before it grew in North America, the dainty little forget-me-not was cherished by the people of Europe and Asia as the emblem of true love and constancy. The poet Tennyson wrote that it grows for happy lovers.

Transplanted to America, the forget-me-not soon escaped from the gardens to brookside marsh and low meadow. It grows from Nova Scotia southward along the Atlantic coast and westward along the Great Lakes. From April until August its pink-tinted buds unfold into tiny blue blossoms with yellow eyes. The yellow eye, or circle at the center of the flower, seems to be a guide to the bees. It shows them just where to insert their tongues in order to reach the nectar. At the same time they brush both anther and stigma and so fertilize the plant.

The flowers are scarcely half an inch broad. The lower part of the corolla is tubular, spreading out in five flat divisions. There are five stamens. The blossoms are loosely clustered on one side of a slender, creeping stem 6 to 18 inches long. The leaves are light green, oblong and lance-shaped, somewhat shiny on top and hairy underneath, growing alternately on the stem.

Forget-me-nots belong to the borage family, *Boraginaceae*. The true or European forget-me-not is *Myosotis scorpioides*. A native American species very similar in habits and appearance to the European species is *Myosotis laxa*. Cultivated garden species most commonly raised are *Myosotis sylvatica* and *Myosotis alpestris*. They usually flower in the spring. **FORMALDEHYDE.** This sharp-smelling gas may be highly important in nature. Many biochemists suspect that plants start photosynthesis or the manufacture of starch and sugar with a drop of sunlight by joining carbon dioxide and water into formaldehyde.

In manufacturing, we use large quantities of it to harden various resins into plastics. It is also a powerful germ killer. It can be used as a gas to disinfect rooms and in solution to preserve biological specimens. A 40 per cent solution in water and a little methyl alcohol is called *formalin*. Scab smut and other fungus diseases of potatoes, oats, and wheat can be prevented by soaking the seed plants in water which has one part in 240 of formalin. It is

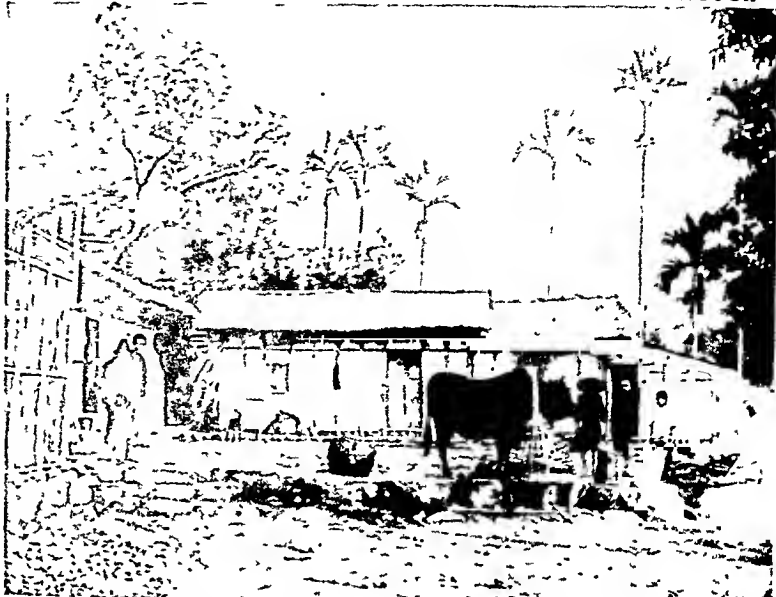
also a food preservative; but this use is forbidden in most states.

Formaldehyde is a compound of one atom of carbon, one atom of oxygen, and two atoms of hydrogen (CH_2O). It dissolves in alcohol or water. A variant form, paraformaldehyde, or *paraform*, has the same elements but is a white powder. It is made by adding sulphuric acid to a formaldehyde solution. Formaldehyde is made by passing methyl alcohol vapor and air over heated copper or platinum. The metal acts as a catalyst, uniting parts of the alcohol and air into formaldehyde gas (see Chemistry, subhead "Catalysis"). This is collected in alcohol or water.

FORMOSA. Bold Portuguese traders sailing the East China Sea in 1590 sighted an island of towering, forested mountains. They called it *Ilha Formosa*, or Beautiful Island. Unknown to them the island had an older name. Chinese sailors called it *Taiwan*, or Terraced Bay, because on its west coast the mountains shelve down into a green and fertile lowland, notched by many sheltered bays.

Formosa lies about 100 miles off the east coast of China. Shaped rather like an elm leaf, the island is some 250 miles long from north to south and about 90

TYPICAL CHINESE FARM HOME ON FORMOSA



The stones in the foreground and the foothills in the distance show that this farm is near the fertile coast plain in west Formosa. Notice the palm trees. The Formosan lowlands are tropical. The thatched-roof houses have dirt floors. The water buffalo is Formosa's chief work animal.

miles at its widest. Its area is about 14,000 square miles, a little larger than Massachusetts and Connecticut together. The Pescadores Islands between Formosa and China are governed as a part of Formosa.

The Tropic of Cancer divides the island, and so its lowlands are tropical. Their winter temperatures average 60° to 65°F. ; in summer the average is 80° to 85° . The northeast monsoon drenches north Formosa in winter. The milder southwest monsoon sweeps the south in summer, but typhoons bring autumn floods.

FORMOSA'S UNIQUE INDUSTRY AND SOME FORMOSAN ABORIGINES



A young Chinese chips a piece of camphor tree for distillation (left). Camphor trees grow in the almost impassable wilds of east Formosa. Until the Germans developed synthetic camphor in the early 1900's Formosa had a monopoly on camphor. Formosan aborigines walk toward their mountain village carrying bamboo lengths filled with water (right). Notice their proud features.

About 330 earthquakes a year shake the island

Two thirds of Formosa is mountainous. A giant range runs the length of the island with 48 scattered peaks rising over 10,000 feet. The highest Mount Morrison soars to 13,595 feet. East-coast cliffs plunge 6,000 feet to the deep water of the Pacific.

In the west the mountains drop gradually to barren foothills then to the fruitful coastal plain. This is only about 20 miles wide but it is where most of the people live. Rivers crisscross it pouring silt and precious farm soil into the shallow Formosa Strait.

How the People Live

About two thirds of the people farm or work on plantations of tea, sugar or pineapple. Since they work some 2,116,000 acres the population density for cropland is about 1,570 persons to the square mile.

More than 90 per cent of the people are Chinese. They keep the language and customs of south China.

The natives of Formosa are aborigines. They total only about 150,000. Their skin is brown. They are slender of medium height but strong of muscle. Many wear face tattoos. Their language and customs are like those of the Malayan tribes in the Philippines. They live in craggy central and eastern Formosa.

Until shortly before the second World War they were head hunters. The Japanese then rulers of Formosa broke them of that savagery. But many are still primitive. Some men wear only loincloths. The aborigines live in villages of bamboo huts and chickens and swine are raised. A favorite food is stew made from a giant snail, sometimes six inches long.

A growing number are settling into farming. These no longer tattoo. Their clothes are westernized. They grow breadfruit, rice, sweet potatoes and tea.

Chinese Do the Work

In the cities the Chinese live as crowded as their relatives in south China. Farm villages dot the coast plain with clay brick huts. Almost all have electric light, unusual for Asiatic peasants. This is because Formosa has extensive hydroelectric power.

When the Japanese ruled Formosa as a colony (1895-1945) they used the Chinese immigrants to develop its rich resources. Today Chinese farmers plant about half the cropland to rice, twice a year. Other main crops are sugar, sweet potatoes, tea and pineapples. Much of this is normally exported to Japan and China.

ENTRANCE TO THE TAROKO GORGE



This is one of the many deep gorges that slash the rugged mountains of east Formosa. The river is also 1,000 feet wide. This wild region is the home of the aborigines.

More than two thirds of Formosa is forested. It is the world's chief source of natural camphor. Cryptomeria trees are used for pulp for making paper.

The Chinese mine some gold and copper. They evaporate salt from the sea and quarry limestone for cement. The refining of native petroleum in the north is increasing. Textile mills import wool and other fibers for making cloth.

Formosa's manufacturing is based on hydroelectric power. Most of it comes from Sun Moon Lake, some 2,400 feet up in the peaks of central Formosa. A vast potential remains to be used.

The capital Taipei and the chief port Keelung are in the north. They are linked by rail with Tainan and other main cities in the western lowlands. A highway blasted from the mountains twines the length of the wild east coast.

The first Europeans to settle on Formosa were the Dutch. They built a fort, Zeland, on the west coast in 1624. A few years later the Spanish tried to establish a colony but the Dutch drove them from the island. In 1662 the Dutch were expelled by the patriot Koxinga, son of a Japanese mother and Chinese father. The Chinese called him Cheng Cheng-Kang. He used Formosa as a base in his fight against the Manchu conquerors of China. But in 1683 the island fell to the Manchus. Then thousands of Chinese settled in Formosa. In 1895 China was forced to cede it to Japan after the Sino-Japanese War.

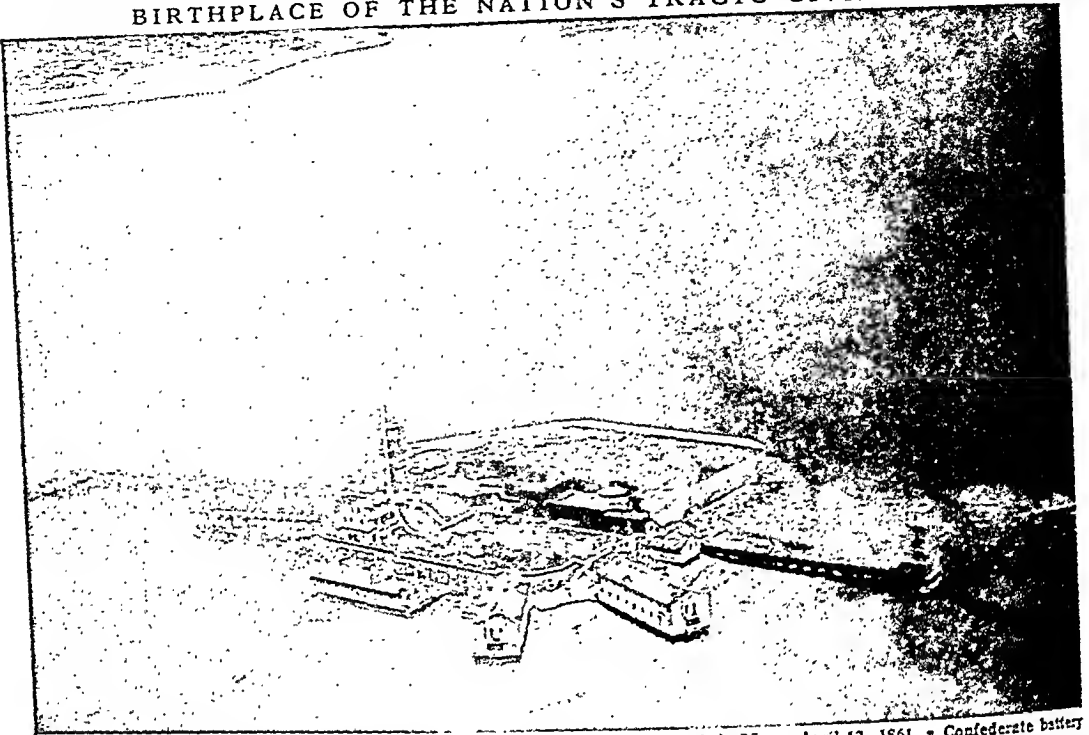
Formosa Becomes Chinese Refuge

In 1947, after the second World War, the Allies returned Formosa to Nationalist China. When the Chinese Communists overran China in 1949, the Nationalist government of Chiang Kai-shek fled to Formosa. The United States sent a naval patrol to protect it and in 1951 shipped arms to Chiang's 500,000 troops.

Chiang planned to make Formosa a base for launching a reconquest of China, but the United States feared the attempt would extend the Korean War. In 1953, however, it lifted the naval patrol, freeing Chiang for future action. Population (1953 estimate) 8,212,213, exclusive of Chinese refugees (see China).

FORT SUMTER Startling tragic news flashed over the United States on April 12, 1861. People throughout the nation learned that the South had fired on Fort Sumter. The long feared Civil War had begun.

BIRTHPLACE OF THE NATION'S TRAGIC CIVIL WAR



This air view shows Fort Sumter, built in the harbor of Charleston, S. C. At 4:30 A. M. on April 12, 1861, a Confederate battery shelled the fort. The Civil War had begun. Sumter's brick walls are five feet thick. They rise 40 feet.

The fort was named for a Revolutionary War hero, Thomas Sumter. The Federal government had begun building it on a small island in the harbor of Charleston, S. C., in 1829. But since the nation was at peace, construction lagged, and the fort was still not finished when South Carolina seceded on Dec. 20, 1860. South Carolina claimed that secession entitled it to all government property within its boundaries. President Buchanan refused to give up forts in seceded states, but promised not to send reinforcements.

When the dispute began, Fort Sumter was unoccupied. But Maj. Robert Anderson soon moved his small force into Sumter from Fort Moultrie, a weaker position in the harbor. Fort Sumter was besieged from this time until the outbreak of the war. On April 11, Gen. P. G. T. Beauregard, commanding the Confederate forces, demanded its surrender. Major Anderson refused. On April 12, the bombardment began. Against overwhelming odds the fort held out till honor was satisfied. Major Anderson was forced to surrender on April 13, announcing his surrender in the following dispatch to Washington:

Having defended Fort Sumter for 34 hours, until the quarters were entirely burned, the main gates destroyed, the powder-magazine surrounded by flames, and no provisions but pork remaining, I accepted the terms of evacuation offered by General Beauregard, and marched out of the fort with colors flying and drums beating, saluting my flag with 50 guns.

Men of the North who had calmly been saying, "Let the South go," were now aroused to fever heat

and enlisted in response to Lincoln's call for 75,000 men. The North gained much in unity of action by the loss of Fort Sumter; the South gained only the fort. When the Confederate forces abandoned Charleston in 1865, Fort Sumter again passed to the North, but as a battered ruin of no military value. It became a national monument in 1948.

FORTUNA. The goddess of fortune was more worshiped by the Romans than by the Greeks, though the latter recognized her under the name of Tyche. By some she was considered a sister of the Fates. She differed from them, however, in working without law, conferring joy or sorrow as she pleased. Greek poets and sculptors represented her with a rudder, with a ball or wheel, or with wings. The Romans proudly said that when Fortuna entered their city, she threw away her ball and put off her wings and shoes to indicate she would remain forever.

FORT WAYNE, IND. Indiana's second largest city, Fort Wayne, is one of a chain of important industrial centers that stretches between Chicago and the Atlantic coast. Fort Wayne is set amid the rich farmlands of northeastern Indiana. The heart of the city lies close to the point where the St. Joseph and St. Marys rivers join to form the eastward-flowing Maumee. The city has low hills to the north, and its southern section occupies a gently rising plain.

The French established a fur-trading post here in the 1680's, and almost a century later it was taken by the British. At the time of the American Revolution,

Indians held the post. George Washington thought the site important to the development of the Northwest Territory. After Gen. Anthony Wayne's victory over the Indians at Fallen Timbers in 1794, a stockade was built at the river junction and called Fort Wayne. This fort withstood several Indian attacks. Danger from attack lessened as more settlers came to clear farmlands, and in 1819 the fort was abandoned.

A village had grown around the fort. Its early prosperity came from the fur trade. Boats carried trade goods on the three rivers, and a short portage gave Fort Wayne traffic with the Ohio over the Wabash. An even larger trade resulted when the Wabash and Erie Canal opened in 1843. The first railroad reached Fort Wayne in 1854. Thereafter canal commerce declined, but the city continued to grow in population and wealth. The early industries included boatyards, sawmills and gristmills, tanneries and distilleries. Today the city's modern plants manufacture radio and television sets, other electrical goods, heavy machinery, boats, filling-station equipment, farm tools, and various metal products.

Many Fort Wayne parks are located along the river banks. The museums include one on city and county history, another on art, and a third with a notable collection of Lincolniana. The War Memorial Coliseum was completed in 1951. Among the schools are Indiana Technical College, Concordia College (Lutheran), St. Francis College (Roman Catholic, for women), and the Fort Wayne Bible Institute.

Fort Wayne is the seat of Allen County. It was incorporated as a town in 1829 and chartered a city in 1840. The government is the mayor-council form. (See also Indiana, Northwest Territory, Wayne.) Population (1950 census), 133,807.

FORT WILLIAM, ONTARIO. At the head of Lake Superior stands the thriving city of Fort William, three miles from its sister city Port Arthur. Fort William has one of the best harbors on the lake, which is formed by the mouth of the Kaministiquia River. Enormous grain elevators dot the two cities since the head of the lake is the funnel through which passes much of the wheat from the prairies of the Canadian Northwest.

After the grain is harvested in Manitoba, Saskatchewan and Alberta, long freight trains bring it to these great elevators. Combined they can store more than 90 million bushels at one time. From the elevators the grain is loaded on boats or trains and sent to the United States, to eastern Canada, or to England. Fort William is also the greatest coal-handling center of western Canada. Port Arthur has large ore docks and is near a gold mining center.

Wood pulp, paper, lumber, busses, and marine supplies and equipment are manufactured or marketed in the two cities. Port Arthur has one of the largest shipyards and dry docks in Canada. The surrounding forests, lakes, and streams offer unexcelled opportunities for hunting and fishing, and important revenues are derived from summer tourists. Scenic highways connect the cities with Duluth and Winnipeg.

The public utilities in both Fort William and Port Arthur are municipally owned and operated. The name Fort William recalls that this town was established (in 1803) as the trading headquarters of the North West Company. Population of Fort William (1951 census) 34,947; of Port Arthur 31,161.

FORT WORTH, TEX. The old Southwest of cowboys and cattle and the new Southwest of oil and industry join in the north-central Texas city of Fort Worth. In the west lie the rolling treeless plains of the cow country; to the north and west lie great oil fields; and to the east spread the fertile farmlands called Grand Prairie. Two forks of the Trinity River join made the city northwest of the business district.

Upstream from Fort Worth the Trinity has been dammed to provide the city with water. The lake created by this dam provides the city with a water recreational area. Fort Worth parks contain about 10,000 acres of land. Texas Frontier Centennial Park has the 210-foot Memorial Tower, the Municipal Auditorium and the Will Rogers Memorial Coliseum, where the Southwestern Exposition and Fat Stock Show is held every year. The colorful Botanic Garden lies within Rock Springs Park.

Among Fort Worth schools are Texas Christian University, Southwestern Baptist Theological Seminary, Texas Wesleyan College and Our Lady of Victory College (Roman Catholic for women). The campus and farms of North Texas Agricultural College are in the near-by town of Arlington. Also near Fort Worth are a Masonic home for children, a U. S. Public Health Service hospital and Carswell Air Force Base.

Gas fuel for industrial and home use keeps the city free of smoke and grime. Besides great stockyards and meat-packing plants, Fort Worth's industries include oil refineries, airplane factories, oil well machinery plants, railroad workshops, flour and feed mills and candy factories.

A military post (called Camp Worth for Gen. William J. Worth, a leader in the Mexican War) was established on the city's site in 1849 to guard settlers from Indian attacks. The settlement that grew around the camp was named Fort Worth. After the Civil War many of the cattle drives to rail lines in Kansas originated near Fort Worth; the town prospered as a cattlemen's supply and trade center. The first rail line entered the town in 1876, and Fort Worth then became an important stock shipping point. Oil was discovered near the city in the early 1900's, and Fort Worth became an oil center.

Fort Worth is the seat of Tarrant County. It was incorporated as a city in 1873, and adopted a council-manager government in 1925. (See also Texas.) Population (1950 census), 278,778.

FOSSILS. Did you know that if you should start digging deep down under your own house you might find the remains of strange animals and plants unlike anything alive today—the bones of huge monsters that perished millions of years ago, the trunks of ancient trees turned to stone, the molded

forms of huge insects, of queer fishes and shells, of birds with teeth, of real sea serpents, of hundreds of other relics of bygone ages? Not all these things would be found in any one place, to be sure, but all such things have been found in places very widely distributed over the earth.

Such relics are called fossils, from the Latin word meaning "to dig." By studying them, scientists have been able to piece together some of the most important pages in the history of the earth and its inhabitants. They have proved, for instance, that the rocks in the Rocky Mountains, the Alps, and the great Himalayas were once below the level of the ocean, for the remains of sea animals have been found high up on their slopes. From fossils we have learned also that the forebears of the camel once roamed the plains of North America; that tropical forests once covered the

animal was buried and decayed, leaving a hollow mold which filled up with mineral matter forming a cast of the animal's shape. Sometimes the bones and teeth themselves have survived in dry locations. Under exceptional circumstances, even the flesh of ancient animals has been preserved, as in the case of the mammoths embedded in the frozen mud cliffs of Siberia for thousands of years. The meat was so fresh that it is said to have been eaten with relish by the hungry natives of the region.

The science of fossils is called paleontology, and to understand fully its importance you should read the articles on Evolution and Geology. Here we can only mention some of the more amazing discoveries, mostly made within the last 50 years.

Many strange relationships have been made known, based upon the fossils of some of the animals which

came into existence in the early days of the world's history. The seal and the elephant are believed by some men of science to have had a common ancestor. While such widely different creatures as the moose, the giraffe, the hippopotamus, the sheep, the pig, and the camel are said to spring from a single type of primitive mammal, whose bones now rest in our museums. The ancestor of the modern horse, which was a tiny creature, no bigger than a fox terrier, was a close relative of the rhinoceros family (see Horse).

The strangest of all creatures which have been dug

up out of the earth are the giant monsters of the Reptile Age—the dinosaurs, the ichthyosaurs, and other scaled, horny creatures of dragonlike appearance (see Reptiles). Some of these old reptiles were about 100 feet long and certainly the largest land animals that ever lived. These illustrate a tendency noticeable to those who study fossils—that the farther back we go the smaller do we find the proportion of brain space in the animal's skull. Hundreds of animal species of great size and strength died out and made way for creatures with more brain and less bulk. The latest of all fossil remains are those of early man, found with the bones of the great animals—the mammoth, the bison, the cave bear—which he was able to kill for food (see Man).

Fossil Remains in North America

Although most parts of the earth yield fossils, both the United States and Canada are noted for their particularly rich and varied remains of the larger reptiles and mammals. Among the most famous deposits are those of Wyoming, Nebraska, South Dakota and Colorado. Rancho La Brea in Los Angeles, Calif., is

SOME ANCIENT EGGS FROM CHINA



These dinosaur eggs, several million years old, were unearthed in the Mongolian desert by an American expedition. Careful restoration by museum experts revealed the remains of unhatched young dinosaurs in some of them.

United States and Europe, and a luxuriant vegetation grew where the polar regions now exist.

Fossils have told us that the great coal and chalk beds of the world were formed from the remains of living things, and that millions of years before the pyramids of Egypt were dreamed of tiny animals were making shells which became the limestone of which parts of those pyramids are built.

Fitting together the scattered parts of the fossil story, science has traced animal life back to the earliest worms and shellfish. It has shown how, one after another, appeared the cartilaginous fishes like sharks, the amphibians (half-land, half-water animals like the frog), the insects, the reptiles, the birds and bony fishes, and, last of all, the mammals.

Fossil plants and fossil animals are found in many forms. Some fossils are nothing more than the footprints of prehistoric beasts in the mud of bygone ages which have been buried and preserved under fresh layers of sand or silt. Frequently a fossil is the delicate imprint of a leaf on some soft material which later hardened into solid rock. Sometimes the body of an

THE MAKING OF A FOSSIL



1 Ages ago thousands of brontosaurs lived in the warm swamps and fern forests that dotted the western United States. There came the great upheaval that formed the Rocky Mountains.



2 The waters drew away and the fern forests died. The stars of brontosaurs now had to hunt for stray bits of green that survived on the edges of a few mud pools.



3 Weak and helpless, many of the great reptiles fell easy prey to their flesh-eating cousins. In the struggle at the pools, a triceratops and a velociraptor often fought and the soft mud swallowed them.



4 Protected from the air, the bones were preserved. New soil formed above them, and a world of new plants and animals developed to replace the old.

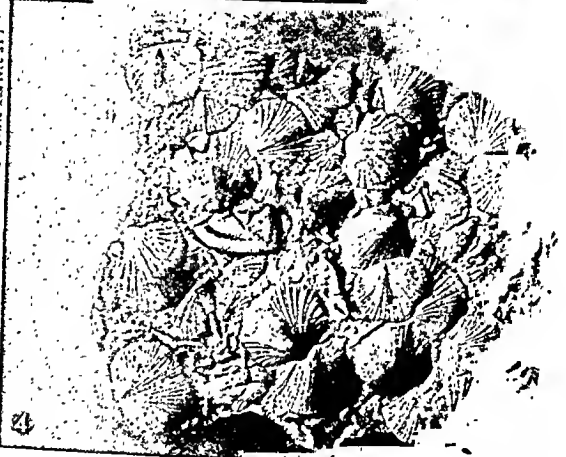
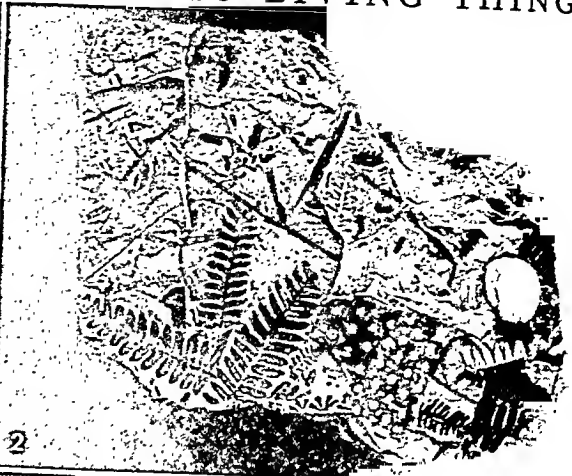
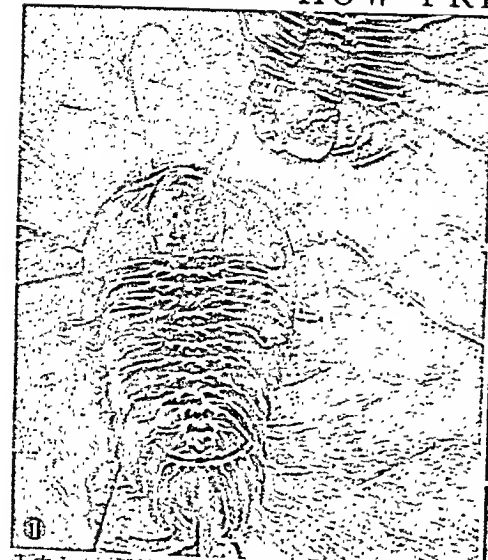


5 Then came a stream that cut down through the earth and exposed the bones.



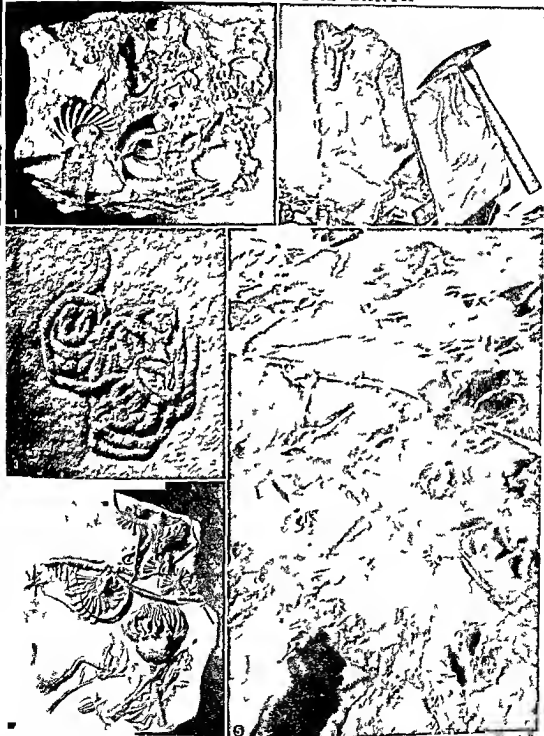
6 So today we see the skeleton of one of those brontosaurs mounted in a museum.

HOW PREHISTORIC LIVING THINGS



1. Among the best-known fossils are trilobites, remote relatives of the horseshoe crab. These specimens are black silhouettes of carbon in lighter colored rock. The creatures died and were buried in mud; their bodies decayed and left behind a film of carbon as the mud turned to stone. 2, 3. Coal Age ferns and a wormlike creature left similar carbonized fossils. 4, 5. These fossil shells and petrified trees were formed in a different way. For millions of years, water dissolved away their original materials, replacing these with minerals. The fossils are really reproductions in stone of the original objects.

LEFT STONY RECORDS IN THE EARTH



Here are some special kinds of fossils. 1 The hollows in this rock were made by an lent snail and mollusks. The shells themselves have disappeared. 2 Sand filled the burrows of prehistoric worms to form these interesting fossils. 3 Some burrowing creature left a coiled casting, such as an angler's mud today, but this one has hardened into stone. 4 The fossils of these sea lilies resemble a bee relief. Their bodies made impressions in the mud, later mud filled the impressions and turned to stone. 5 Here dinosaurs tramped across a mud flat which hardened to stone and preserved their tracks.

the most spectacular fossil area in the United States. Its sticky pools of oil and asphalt trapped thousands of prehistoric animals much as flypaper catches flies. Saber-tooth tigers, giant wolves and sloths, mastodons, short-faced bears, and horses have been uncovered here in a remarkable state of preservation.

Fossil Remains Used in Industry

Some types of fossil deposits have considerable industrial importance today, especially chalk (*see* Chalk) and diatomite. Diatomite is the fossil remains of microscopic plants called diatoms, which live in fresh and salt water (*see* Ocean), and even in damp soil. In the polar regions they are so dense that they color the snow and ice. Their flinty skeletons are deposited on the floors of the world's seas, lakes, rivers, and swamps, and on ancient sea beds. These gray-white deposits, called diatomite, diatomaceous earth, kieselguhr, or infusorial earth, are mined in California, Nevada, Washington, and other states, and in Germany, Denmark, Russia, Algeria, Japan, and France. Diatomite is used as a filter in sugar and oil refining, as an insulator against heat and sound, as a rubber and cement filler, and as an abrasive in dentifrices and metal polishes.

FOSTER, STEPHEN COLLINS (1826-1864). The short life of Stephen Foster was marked by contrasts. He won fame for his songs of the South and plantation Negroes, yet he was a Northerner. He made the Swanee River famous, yet he never saw it. His brother found the name in an atlas, and Foster used it because it sounded more musical than his first choice, the Pedee River. Many of Foster's melodies speak with haunting tenderness of family and home, yet he died homeless and alone in a hospital charity ward.

Foster was born in Lawrenceville, Pa., now a part of Pittsburgh, July 4, 1826. He was of Scotch-Irish ancestry. At 15 years of age he entered Jefferson College, but his only interest was music. He had already composed a waltz for four flutes. He left college after only a month, then studied with tutors. His family objected to a musical career, and so in 1846 Foster went to Cincinnati to be a bookkeeper

for his brother. In 1848 some of his ballads were published, including 'Uncle Ned' and 'Oh! Susanna'. At their success, he returned home to write. In 1849 his song 'Nelly Was a Lady' was made popular by the famous Christy Minstrels. In 1850 Foster married Jane McDowell. They had one daughter, Marion.

STEPHEN FOSTER



This lonely composer wrote songs about home and family.

While on a trip to New Orleans in 1852 Foster stopped in Kentucky to visit a cousin's house, called Federal Hill, near Bardstown. There, it is said, he wrote 'My Old Kentucky Home'. This became Kentucky's state song, and Federal Hill a state park.

In 20 years Foster composed over 150 songs

Many were very popular, but made him little money. Some 200,000 copies of 'Old Folks at Home' were sold in the first five years (1851-56), but his royalties were less than \$1,700.

In the last few years of his life he wrote steadily but with little success, except for 'Old Black Joe' in 1860. That year he moved to New York. Separated from his wife, he lived carelessly. Impoverished, he died in Bellevue Hospital Jan. 13, 1864.

Among Foster's still popular songs are: 'Old Folks at Home' ('Swanee River'), 'My Old Kentucky Home', 'Massa's in de Cold Ground', 'Old Black Joe', 'Oh! Susanna', 'Jeanie with the Light Brown Hair', 'Come Where My Love Lies Dreaming', 'Beautiful Dreamer', and 'Camptown Races'. Foster also composed hymns

Foster was elected to New York University's Hall of Fame in 1941. Among the memorials raised to him are several public schools; the University of Pittsburgh's auditorium-shrine; Florida's museum in a 245-acre state park along both banks of the Swanee River at White Springs; and Foster Hall at the Eastman School of Music in Rochester, N. Y.

The Age-old WORK of Helping OTHERS

FOUNDATIONS AND CHARITIES. Ancient records tell of men who gave some of their own wealth or goods to help others. In Egypt, for example, the Ptolemies endowed a library at Alexandria. In Greece, Pliny the Younger supported a school for his native town. Almsgiving was encouraged by all the great religions, and for centuries charity was carried on chiefly by religious groups. Later the guilds took over much of the work. But today the largest gifts come from foundations.

The great fortunes amassed from the wealth of America have made possible this new type of organization. A foundation is a nonprofit organization endowed to perform definite tasks. There are some 500 of these institutions in the United States. Usually the money given to create a foundation is invested and the

income used for the work of the organization, but a foundation may draw upon its principal as well.

The research funds and business methods of these organizations enable them to pioneer in new fields in their work for humanity. The largest sums go to education, research, health, and child welfare.

Franklin Creates First Foundation

Benjamin Franklin set the example for his countrymen in establishing these benevolent trusts. In 1790 he bequeathed to Boston and Philadelphia £1,000 (\$5,000) each to be put out at compound interest for 100 years. The fund was then to be offered as loans to young married artisans. But the apprentice system died out. Few men were eligible for the loan. But the wise old printer had provided that the trustees might later use the fund for public works, and so Franklin

Institute in Philadelphia and Franklin Union in Boston benefited from the fortune.

Earliest of the social service endowments was the Magdalen Society of Philadelphia (1802) now the White-Williams Foundation. In 1829 James Smith, an Englishman, left money to found the Smithsonian Institution. Its famed research and educational work continues today. Peter Cooper's Union founded 1857-59 still carries on its task of educating workers. Ezra Cornell, Matthew Vassar, Johns Hopkins

totalled some \$417,000,000. It works to promote world peace, democracy, economic well-being, education, culture and understanding of human conduct.

The service of the great foundations reaches to nearly every part of the world. Their grants include funds for international peace, funds for scholarships and fellowships, funds for medical schools in Peru, India, and elsewhere, funds for stamping out yellow fever, typhus, and other scourges. George Eastman established gifts of some \$75,000,000 for dental clinics

for the school children of Rochester, N. Y., London, Rome, Stockholm, and Paris.

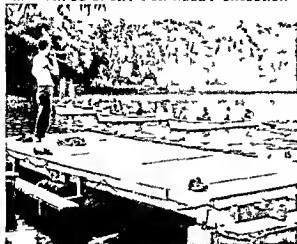
A Better Chance for the Child

Many of the men and women with millions to give want to help children. A large share of the Commonwealth Fund of Mrs. Stephen V. Harkness goes to child welfare in Europe and America. The \$47,000,000 Kellogg Fund gives largely to this cause, as do the Edwin Gould Foundation, the Heckscher Foundation, and the Children's Fund of Michigan with its \$7,000,000 endowment from James Couzens. The Hershey Fund educates orphan boys. Newsboys are the wards of the Harry E. Burroughs Foundation in Boston.

Millions have been set aside for scholarly and scientific research and for health promotion work of all kinds. Foundation scientists peer through their microscopes seeking the germ of one dread disease or the cure of another. Or they plunge into steaming tropical swamps in a campaign against yellow fever. Sometimes they sacrifice their lives to save thousands of their fellow men.

Better public health in America's cities is the aim of the Milbank Memorial Fund. It has selected two cities in which to carry out an ideal program. The fund works especially to promote child welfare, mental hygiene, and private and community health. Three foundations give their support solely to projects

HEALTHFUL SPORT FOR NEEDY CHILDREN



At Camp Algonquin near Chicago, hundreds of the city's underprivileged children enjoy summer vacations. The camp is operated by Chicago's United Charities. Here we see a camp counselor teaching boys how to row boats.

Leland Stanford and James B. Duke were among the leaders in supporting colleges.

George Peabody poured out his wealth for the support of schools in the war-torn South in 1867. About a half century later Julius Rosenwald established a \$20,000,000 foundation for the well-being of mankind. The fund was used largely to improve education and health facilities in the South and for work in Negro-white relationships. Rosenwald directed that the entire fund be spent within 25 years from the date of his death. The foundation therefore completed its work in 1947.

Among the leaders in the formation of great foundations in the United States were Andrew Carnegie, the Rockefellers, and Henry Ford (see Carnegie-Ford Rockefeller). Heading the Carnegie benefactions is the \$135,000,000 Carnegie Corporation, founded for the diffusion of knowledge. The chief work of the Rockefellers is done through the Rockefeller Foundation, which contributes mainly to research in the medical sciences and the General Education Board, which contributes to the support of educational research, experiment, and publication. The Ford Foundation is the largest public trust. In 1951 its fund

THE FLAG IS RAISED AT A CHILDREN'S CAMP



Raising the flag is a daily ceremony at Camp Algonquin. At camps like this, needy men, women, and children find refreshing relief from bleak homes. Gifts to community charities make such camps possible.

A RESEARCH FOUNDATION'S LABORATORIES



for the advancement of mental health work

Endowing the Artist

The arts receive about \$1,000,000 a year from endowment funds. The Juilliard Musical Foundation helps to educate talented music students. Several trusts give scholarships, prizes, and other aid to encourage the fine arts. The Guggenheim Foundation awards fellowships for study at home and abroad. They are given to scholars of demonstrated ability who wish to do creative work in any of the fine arts, or to carry on research. Many endowments aid social welfare work. The Russell Sage Foundation studies social conditions and methods and makes its findings public.

Persons who cannot give large endowments may contribute to organizations like the Commonwealth Fund of New York and the Cleveland Foundation. Gifts to organizations such as these are used by the directors as they think best.

Some of the early endowment donors planned to make their funds and their work perpetual, but sometimes the need for the fund ceased. Today givers are providing that principal as well as interest be spent in a few years, or permitting the administrators to change its use to meet new problems.

The Growth of Social Work

The foundations do important work, but they provide only a small part of the money given for benevolent purposes. The major tasks of philanthropy (the word means "love of mankind") are carried on by other agencies. On the average, a total of more than

\$2,000,000,000 is given away each year in the United States alone.

Until recent times, benevolent people looked upon poverty and misery as necessary evils. They tried to help but not to cure. Now they seek not only to assist the unfortunate, but also to cure and prevent society's ills. The problem of how best to help mankind has become a common study in universities and colleges. More than 75,000 professional social workers are now in this field of service.

The rapid development of social work began in the 19th century. When the development of factories called great masses of people from farms and villages to the slums of growing cities, the need for charity multiplied. Hundreds of new philanthropic groups arose. Some organizations sponsored

better care and instruction for the blind, deaf, and dumb, and other unfortunate. The Society of Saint Vincent de Paul was formed to head Catholic world charities. The Salvation Army, the order of Deaconesses, and other Protestant groups came into being.

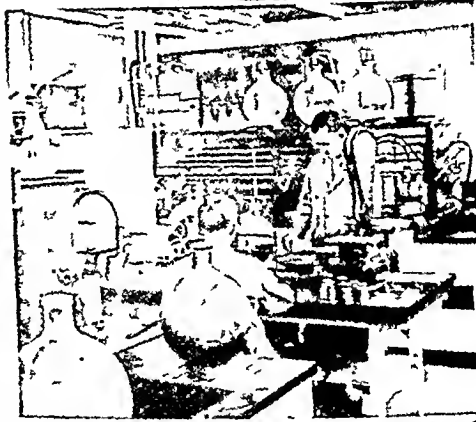
New Times, New Problems

As problems grew, more societies were formed. Working toward the ideal of a world of healthy, happy, self-supporting people, they urged the spread of schools to fit folk to earn a livelihood and to live a broader, fuller life. They agitated for better housing and sanitation, bet-

ter food, and purer water and air to keep people well. They founded hospitals, sanitariums, and dispensaries to care for the helpless in illness. Clinics for mothers and babies, medical and dental examination in the schools, school lunches, parks and playgrounds for crowded districts, and many other child welfare services were organized.

These societies campaigned for laws and regulations to shorten the working day, to improve factory conditions, and to raise wages. Workmen's compensation laws were passed to aid those injured in industry (see Employers' Liability). They petitioned government agencies for still greater services.

Kindly, intelligent men and women went to live among their less fortunate fellows (see Addams, Jane). They knew that really to help the poor, they must give understanding and sympathy as well as food and clothing. They organized the social settlements which are sprinkled throughout the slums of the larger cities and thus developed the profession of the social worker (see Social Settlements; Sociology).



In the laboratories of the Wisconsin Alumni Research Foundation at the University of Wisconsin, scientists carry on hundreds of research projects in chemistry. The foundation has a large income from patents which it owns. It was organized in 1925.

The work of welfare societies sometimes overlapped. This led to the development of central headquarters—sometimes called Councils of Social Agencies—to coordinate the work of all groups to keep records of each case and of the help given by each agency.

Next, many cities bound together their welfare societies to collect funds. Each year a single "drive" endeavors to fill a city's "community chest," and the money is divided among its member groups.

Public Agencies

Until a few years ago the word "charity" was generally used. But now "social welfare" is more and more taking its place because the object is to help the unfortunate to fare well. Up to the beginning of the 20th century most of the progress in methods of charity was made by private agencies. Now both private and public agencies have improved so much that trained social workers go to either one.

Some private agencies have institutions to take care of orphans, the blind, deaf, insane, feeble-minded and delinquent. But these classes of unfortunates are generally cared for in institutions supported by the city or state and paid for out of taxes (see Poor Relief). Hospitals are still supported more by private philanthropy than by taxes. Most cities have health departments and free clinics for the sick.

An important phase of social welfare is providing for the support of children of widowed mothers. This was done through "mothers' pensions" granted by local governments until passage of national and state social security laws (see Social Security).

The object of social work is to help people to cope with their environments. Since the beginning of the 20th century the number of schools for social work has increased steadily. New and more scientific methods for dealing with social problems are constantly being developed.

Welfare workers are on the job all the time. That is how they differ from such agencies as the Red

Cross, which gives help chiefly in time of great disaster, such as flood, tornado, fire, or war, where the need is so great that help cannot be provided locally (see Red Cross).

So that social workers may learn from each other's experience there are state conferences that meet every year. The National Conference of Social Work is attended annually by those interested in religious, private and public agencies.

Aid in the Wake of War

The second World War created a huge burden of relief needs. Hunger and misery swept across the countries devastated by war, leaving thousands of needy people. Welfare agencies, both public and private, immediately began to provide aid.

In the United States the American Council of Voluntary Agencies for Foreign Service coordinates the work of nongovernmental agencies. More than 60 organizations are registered with the council. In addition the Cooperative for American Remittances to Europe (CARE) was organized to receive relief supplies especially food from donors in America, and to forward them to Europe.

The Ford Foundation is another welfare organization that became active on a broad scale after the second World War. It was originated by Henry and Edsel Ford in 1936 (see Ford). Today this foundation is a 500-million-dollar trust, the world's largest trust operating in the interest of human welfare. The income from this money is used to raise world standards of education and to promote world peace. The foundation awards teaching fellowships, supports the creation of informed discussion groups on international relations and provides funds for the preparation of films, radio and television programs and publications in this field. Its plans for the future include a center where scholars from all parts of the world will work together to solve the problem of what prevents man from living at peace with his fellow men.

EDUCATIONAL PROJECTS IN THE INTEREST OF HUMAN WELFARE



A part of the Ford Foundation's program is the advancement of education. Television productions such as this one are sponsored by the foundation to bring advances in the arts and sciences



Democratic education in the Free University of West Berlin is another way the foundation promotes world peace by bringing about a greater understanding of international problems.



Helping to Build a BETTER AMERICA with the 4-H CLUBS

4-H CLUBS. Rural boys and girls, like nearly all young people everywhere, want to do something worth while. They want to take part in important activities. They want to feel that part of the world's work is theirs to do. They want to plan both what they would like to do as individuals and what they would like to do as a group. 4-H Club work makes it possible for rural youth to satisfy such desires through a wide variety of work and play experiences in the home, on the farm, and in the local community.

The 4-H Clubs form the largest rural youth organization in the world. The clubs have more than 2 million members pledged to the fourfold development of Head, Heart, Hands, and Health. The motto is "To make the best better," not only in building character and citizenship but also in raising the standards of club projects. The badge is a green four-leaf clover with a white "H" on each leaf. The clubs are sponsored by the United States Department of Agriculture and the state agricultural colleges.

Each 4-H Club is made up of five or more members between the ages of 10 and 21. The county extension

THE NATIONAL 4-H CLUB PLEDGE

I pledge—

*My Head to clearer thinking,
My Heart to greater loyalty,
My Hands to larger service, and
My Health to better living, for
my club, my community, and
my country.*

agent and the home demonstration agent supervise the organization and approve programs. Members work on projects under local leaders. Each group carries on an activity that shows some improved practice on the farm, in the home, or in the community. Thus 4-H Club members promote the use of modern methods in their community. At the completion of the project the club holds an Achievement Day program in competition with similar clubs.

Learning to Do by Doing

Learning to do by doing is a basic rule in all 4-H Club work. The girls may refurbish a room, make clothes, or grow a vegetable garden and can the surplus or prepare it for the home freezer (see *Farm Life*). The boys may grow an acre of corn, wheat, or some other crop. Either boys or girls may raise a flock of poultry, a prize beef, a litter of pigs, or a small flock of sheep. They reforest their farms, landscape the home grounds, purify their water supplies, check erosion, control insect and weed pests, and create wild-game preserves. Many of them earn money for their higher education from such projects.

The value of controlling soil erosion is now particularly appreciated and is a steady job for many 4-H members. They ditch, terrace, lay drainpipes, seed old fields of grass, fill up gullies, and build ponds and dams (see *Conservation*).

4-H camp members learn how to protect wildlife. This varies from halting erosion to feeding quail. It stresses that many wild creatures—even hawks, gulls, foxes, and snakes—do more good than harm. Rat killing is so important that worth-while prizes reward it. Rats eat more than 200 million bushels of grain each year in the United States.

To raise funds some clubs put on pageants or plays, making their own costumes and stage properties. Others give orchestral or band concerts with instruments bought through sales of their own produce. Members win substantial cash prizes at state fairs and at the International Live Stock Exposition, held annually in Chicago. On many state fairgrounds 4-H members have their own exhibit buildings.

4-H Clubs also sponsor good times—country style for boys and girls. They hold community singings, pull cornhusking bees, barn dances, rodeos, box lunch suppers, summer hay rides, winter sleigh rides and other recreational activities.

In a typical year the more than 2 million 4-H Club members in 90,000 clubs, under the guidance of more than 250,000 local volunteer leaders, produce at least a million acres of garden and farm crops and raise a million head of livestock and nine times that number of poultry. In homemaking 4-H members preserve at least 11 million quarts of food, prepare about 20 million meals, improve nearly a million homes and make more than 2 million garments for themselves and their families. In addition, 500,000 members take part in fire and accident prevention, 130,000 make use of special economic information, 500,000 conduct conservation practices, 700,000 carry on special health activities, 240,000 train in home nursing and first aid, 235,000 conduct recreational activities and 415,000 demonstrate improved farm and home practices to others.

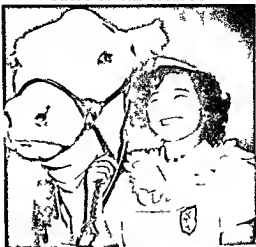
The National Camp and Congress

Every June two boys and two girls from each state and territory of the United States are sent to the National 4-H Club Camp at Washington, D. C. Here some of them camp beside the Potomac River while others stay at hotels. Of keen interest to the young farm boys and girls is seeing the government at work. They also visit the Agricultural Research Center at Beltsville, Md., where important scientific farm experiments are carried on.

Active good citizenship is a key part of all 4-H Club work. When 4-H youths reach voting age for example, they give a Citizenship Pledge in which they dedicate themselves to upholding American ideals as voting citizens (see Citizenship).

Every November about 1,500 state and regional project winners attend the National 4-H Club Con-

PRIDE OF THE ISLANDS



Like their counterparts on the mainland, the young people of Hawaii are eager to achieve 4-H workers. This smiling young Oahu Island girl is showing her prize certificate at a Honolulu 4-H meeting.

gress held in Chicago at the same time as the International Live Stock Exposition. Here at this junior-sized fair within a fair excitement runs high as the young people await the results of the judging of their exhibits. Cash prizes and ribbons are awarded the winners, but it is mainly intense pride that spurs 4-H exhibitors to the effort it takes to prepare a Blue Ribbon entry for competition.

Free Support Given to 4-H Clubs

Thousands of individuals and many large American corporations give free support to the 4-H work. They present local and national awards ranging from scholarship prizes, breeding stock and farm implements to gold medals, cash prizes and free trips to state fairs and to state and national 4-H conventions.

FATTENING A 4-H CLUB GRAND CHAMPION STEER



The 4-H boys and girls at the left are learning to mix feed for their steer-raising project under the direction of a county agricultural agent. The girl at the right has had her steer declared



the grand champion 4-H baby beef in the International Live Stock Exposition which is held annually in Chicago. Only three girls have won the award in more than half a century.

LEARNING HANDICRAFTS AND UPHOLSTERING



The young Indian girls at this 4-H meeting in a New Mexico school are practicing basketmaking and weaving. The leader is teaching the older girls needlepoint embroidery. Notice that they are using Southwest Indian designs.



Activities for 4-H Club girls include many features of homemaking. This group has learned to sew and has advanced to the tasks of upholstering and making slip covers. Such handiwork decorates many American rural homes.

In addition, the National Committee on Boys and Girls Clubs, with headquarters in Chicago, supplements the 4-H work of the Department of Agriculture. The committee is a privately supported organization which works with various business groups in sponsoring national 4-H contests. It publishes a magazine, directs the programs of the National Congress, and supplies songs, books, and uniforms. The National 4-H Foundation of America, Inc., was set up in Washington, D. C., in 1948, to provide research services and to establish a national training center. In 1951 the National 4-H Center was established in Maryland when the Foundation bought the buildings and grounds formerly occupied by Chevy Chase Junior College. However, the center was then leased to the United States Department of Defense until

1955. Future plans call for making this 12½-acre campus into a national assembly ground for all youths interested in rural life.

Forming World Friendships

Many members of American 4-H Clubs also work on farms in other countries. In addition they show hospitality to young people from abroad who come to work on farms in the United States. This International Farm Youth exchange has helped to bring about a better understanding of the farm life of young people all over the world.

Organizations similar to the American 4-H Clubs have been formed in several other countries. Many have sent representatives to the United States to study the work here. They may vary the names to fit the language of the homeland. Spanish-speaking Venezuela, for instance, calls its clubs the 5-V's, meaning *Venezuela, Valor, Vigor, Verdad, and Vergüenza*. Cuba's are known as the 5-C's, standing for *Cuba, Cerebro, Corazon, Cooperación, and Cívismo*.

History of the Movement

The 4-H Club movement began about the turn of the 20th century when a group of 500 boys in Macoupin County, Ill., banded together to plant seed corn and to produce a crop for exhibit at a local farmers' institute meeting. The first agricultural club for young people closely resembling today's 4-H Clubs was organized near Springfield, Ohio, on Jan. 15, 1902, when school superintendent Arthur B. Graham formed an agricultural club for boys and girls. Members raised vegetables, corn, and flowers, and made soil tests. At meetings they presented programs dealing with farm problems in much the same way that 4-H boys and girls do at their meetings today.

In 1905 the Ohio clubs formed a state organization. The United States Department of Agriculture became interested in the movement and encouraged it, particularly in Mississippi and other Southern states. In the South two-crop farming—cotton and tobacco—had been customary, and the young farm club members demonstrated that it was more profitable to grow a variety of crops.

The farm club idea caught on quickly in all agricultural regions. The Department of Agriculture appointed leaders to form clubs all over the country. In 1914 the Smith-Lever Act helped the movement by providing funds to develop extension work. Each state set up a club department. In the 1920's the name was changed from "Boys and Girls Club Work" to "Boys and Girls 4-H Clubs." The organization has grown steadily at the rate of about 100,000 members a year and has become the world's largest youth group. In the past half century the clubs have trained more than 15 million young people.

FOUR O'CLOCK. In the late summer and autumn when many other flowers begin to disappear from the garden, the four-o'clocks burst into bloom. They are called four-o'clocks because they open their flowers in the late afternoon, and on cloudy days. They close them in the morning. The plant is also known as the "marvel of Peru."

The four-o'clock is a quick growing, erect, bushy herb that reaches a height of about 18 inches. It grows in almost any kind of garden soil and is popular as a ground cover where other plants will not thrive. It is also used as a hedge, or as a screen to hide some unsightly part of the grounds.

The flowers have no petals, but the five-parted, tubular shaped calyx is brightly colored and looks exactly like a petal cluster (corolla). The colors are white, red, yellow, or striped. There are five stamens joined at the base and one pistil. The blossom grows out of a rosette of small leaves (the involucre) either singly or in clusters.

Four-o'clocks are native to the warm parts of the Americas, where they are perennial. In California and the southwestern states several species grow wild. Under cultivation in the north they are treated as annuals and are planted from seed. Even in the north they may produce tuberous roots large enough to be taken up and stored like dahlias and other bulbs, and they sometimes grow from self-sown seed. Scientific name of the garden four-o'clock, *Mirabilis jalapa*.

THE FOUR-O'CLOCKS WAKE UP



In late afternoon, or on cloudy days, the four-o'clocks open their flowers. They are bushy herbs. These plants are blooming in the Mojave Desert.

FOX, GEORGE (1624-1691) The dungeon at Doomsdale prison in England was dark and foul, but George Fox founder of the Society of Friends, refused to leave when given his freedom. Illegally committed, he demanded pardon as well as release. It was a matter of principle, and George Fox lived by principle (see also Quakers).

Throughout his long career in religion Fox was sent to prison eight times. He was often beaten by mobs. But nothing would stop him from preaching. Even as a boy he had been very pious. His parents were Puritans living in Leicestershire, England, where George was born, and he grew up in a religious atmosphere. At 19 he became disgusted with the sinfulness of many professed Christians. He left his family and church and went off alone. After much thought and

reading of the Bible, Fox decided that God was to be found only within the soul of each individual.

Fox was 23 when he began his ministry. He was a grave, massive man, plainly dressed. Traveling from

village to village he preached his new belief of the "Light Within" and soon won many converts. But England was torn by civil war, and authorities suspected this sect which claimed equality for all and refused to take up arms or swear allegiance. Hundreds were jailed. In prison Fox wrote his "Journal" and numerous pamphlets supporting his beliefs. In 1669 he married Margaret Fell, an influential widow whose conversion 17 years earlier had added much prestige to the young movement. Fox made several missionary trips to Ireland, Scotland, Wales, and Holland, and in 1671-72 he journeyed to North America.

FOX. Folk tales say the slyest of animals is the fox. In England, where it is preserved for hunting, stories tell how cleverly the fox escapes the hounds and mounted riders. By stealth and guile the fox has survived even where it is ruthlessly shot, trapped, and poisoned to obtain its fur and to check its thefts of poultry.

The fox is closely related to the dog and the jackal. It is distinguished from them by its sharp muzzle, its erect ears, the elliptical pupil of its eye, and its bushy tail. Foxes are found in Europe, Asia, Africa and North America, with some near relatives in South America. In North America the red fox is most widespread. It is similar to the common fox of Europe. The male red fox grows 41 inches long including its plumelike tail which measures about 16 inches. Upper parts of the body are reddish yellow. Under parts and the tip of the tail are white. Feet and lower forelegs are black.

A freak offspring of the red fox is the black, or silver, fox. Its fur is black tipped with gray. It is rarely found wild, and until recently, its fur sold at enormous prices. Today silver foxes are raised on farms in Canada, the United States and northern Europe. Between the red and the silver is the cross fox, so called from the black markings on its shoulders and back. Most of the fur, however, is reddish and black. The Arctic fox, which ranges southward to Labrador and Newfoundland, has silky fur dark brown to light yellow in summer, but pure white in winter. A freak variety is the blue fox with fur the color of blue smoke. It is rare in the wild state but now is raised on farms. Of low rank in the fur trade is the gray fox. Seldom found north of the Great Lakes, it ranges from the Atlantic, to the Pacific,

GEORGE FOX



Fox introduced very plain garb as part of Quaker practice.

and south to Texas. The gray fox closely resembles the red fox but has slightly longer legs. It is more timid and often climbs low trees.

All foxes are burrowing animals, though they sometimes make their homes in hollow stumps or rock crev-

utters a piercing yelp at mating time. She bears her young in the spring, from three to nine in a litter.

One of the favorite folk tales of the Middle Ages was the beast-epic of 'Reynard the Fox'. The hero's name means "strong in counsel" or "keen-witted."

Because of his misdeeds Reynard is summoned many times to appear before Noble the Lion, King of Beasts, to answer charges brought against him by Isengrim the Wolf, Brun the Bear, Chanticleer the Cock, and others. Each time Reynard's sharp wits save him.

The ancient Reynard tales have been traced to many sources, some even to India. As a group, they took popular form in the borderlands between France and Germany and appeared as a written collection of poems about the middle of the 12th century, first in French, then in German and English. So popular were they in France that the original form of the hero's

name, *Renart* (later *Renard*), became the common French word for fox, displacing the older word *goupil*.

The scientific name of the European red fox is *Vulpes vulpes*, of American red fox, *Vulpes fulva*, of Arctic fox, *Alopex lagopus*.

FOXES THAT ARE HUNTED FOR THEIR FUR

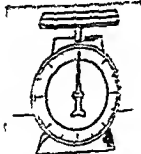
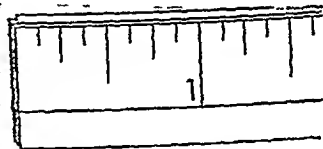


The Arctic fox (left) and the red fox are beautiful creatures. Their beauty is their undoing, for they are trapped and killed in great numbers for their sleek coats.

ices. They hide by day, and by night they hunt birds and small animals such as gophers and rabbits. Occasionally, they eat frogs, fish, insects, and berries. Among the calls of the fox are a curt yapping bark and a shrill howl. The female fox, called a "vixen,"

COMMON FRACTIONS

—How to Use Them



The most frequent use of fractions is in measurements. With a measuring cup and some colored liquid, the teacher or parent can show how many halves, thirds, and fourths make a

cupful. A piece of ruler can be used to draw lines $\frac{1}{4}$ inch, $\frac{1}{2}$ inch, or $\frac{3}{4}$ inch long. A scale that weighs up to one pound can be used to weigh beans or sugar equal to $\frac{1}{4}$, $\frac{1}{2}$, or $\frac{3}{4}$ pound.

FRACTIONS. Numbers such as $\frac{1}{2}$ and $\frac{3}{4}$ are called *common fractions*. Fractions are written with the same symbols that we use to write whole numbers, but the figures are used in a different way. Thus 12 means 1 ten and 2 ones while $\frac{1}{2}$ means 1 of 2 equal parts, or halves of a whole thing or group of things. Fractions are an addition to the Hindu-Arabic number system that was brought to Europe about a thousand years ago. (See Number System.)

Use of Fractions in Measurements

The most frequent use of fractions is in measuring length, liquid capacity, weight, and time. When we want to measure very small amounts of things, we use either small units of measure or fractional parts of larger units. The more accurately and exactly we need to measure, the smaller the unit of measure or fractional part we use.

We know that over 90 per cent of the fractions used in business and industry have denominators that are

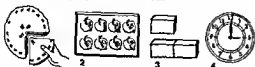
less than 10, chiefly 2, 3, 4, 5, 6, and 8. The solution of an example like $\frac{2}{3} + \frac{1}{4}$ would be very unusual in daily life because fractions with the denominators 3 and 7 do not appear in the same kind of measurement. On the other hand, the example $\frac{1}{2} + \frac{1}{4} + \frac{1}{8}$ contains fractions used in measures of length, weight, and capacity, such as inches, pounds, and quarts. Problems of this sort are common.

The schools today do not teach difficult computations with fractions of little social value. They now begin by emphasizing the meaning and uses of fractions as the need arises in the activities of the primary grades. Later, when fractions have become meaningful to the children and they see their usefulness, the methods of computing with fractions are taught. Every effort is made to teach each step naturally at the time when the need for performing the computations arises and when children have the mental maturity necessary to learn it readily.

Systematic teaching of operations with fractions usually begins in the fifth grade. The most difficult process, division of fractions, is usually taught in the sixth and seventh grades.

Various Uses of Fractions

The illustrations below show the most important ways in which people use fractions.



1 Part of a whole. One fourth ($\frac{1}{4}$) of the whole pie is being taken away and $\frac{3}{4}$ of the pie remains.

2 Part of a group. To find $\frac{1}{2}$ of 8 apples we divide 8 by 2 $\frac{1}{2}$ of 8 = $2 \times 8 = 4$.

3 Comparing things. One block is half as long as the other. In the longer block there are two parts as long as the top block.

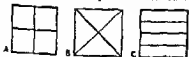
4 Ratio. A space representing 15 minutes is shaded on the face of this clock. One minute is $\frac{1}{15}$ of an hour and 15 minutes are $\frac{1}{4}$ of an hour which is the same as $\frac{1}{2}$ hour. In mathematics we say that the ratio of 15 to 60 is 1 to 4 or $\frac{1}{4}$.

5 Measuring. The $\frac{1}{2}$ pint carton in the picture is a whole container but it is smaller than the pint carton and holds half as much. A half dollar and a quarter are also whole objects but they are of less value than a whole dollar. In the same way $\frac{1}{2}$ inch is really not a thing but a measuring space on a ruler. Similarly $\frac{1}{2}$ hour is not a thing but a period of time.



Various Meanings of a Fraction

The drawings below show several different ways of folding paper squares of equal size into fourths.



The shapes of the fourths in A, B, and C are different yet the fourths are all equal. Halves and fourths of the same thing are always equal but halves and fourths of different things—such as an apple, a pie, or a pound of butter—may be different in size, shape, weight, and many other ways. As a result of many experiences with fractional parts, children will develop such general ideas as $\frac{1}{2}$ of any one thing or any group of things is one of two equal parts of the thing or group.

How Children Learn the Meaning of Fractions

Many young children know the meaning of $\frac{1}{2}$ and $\frac{1}{4}$ when they enter school. They have had frequent contact with these fractions in their experiences in the home as when they are given $\frac{1}{2}$ apple to eat or $\frac{1}{2}$ glass of milk to drink. Rarely do young children understand the fractions $\frac{1}{3}$ or $\frac{2}{3}$ because they have not used these numbers in their activities. Parents can do

much to teach children the meaning of simple fractions by bringing them informally to the child's attention. Natural use is found in preparing food, in telling time, and in sharing things.

The following sequence of steps is recommended for teaching the meaning of fractions.

1 Use opportunities arising in the activities of the school and home to bring to the attention of children the uses of all numbers including fractions.

2 Arrange a natural situation in which you can bring out the meaning of any fraction that is to be presented.

3 Have the child demonstrate the meaning of such a fraction as $\frac{1}{2}$ with objects. For example, he may cut an apple into halves or he may fold and cut a circle or square of paper into halves. Then have him write the fraction as a record of the experience. Have him tell what each part of the fraction means using the objects.

4 Have the child identify the fraction with some measuring device such as a measuring cup or a ruler. Have him use this device to show the meanings of the fractional parts.

5 Have the child identify the fraction in pictures of objects or prepared diagrams that show the fraction. Have him color the fractional part involved in diagrams similar to those shown in this article. Then have him make drawings to show the fractional parts by colors or shadings.

6 When several fractions have been taught, such as $\frac{1}{2}$, $\frac{1}{4}$, and $\frac{3}{4}$, have the child cut out parts of circles and compare the sizes of the fractional parts. With these cutouts he can discover many relationships such as how many smaller parts are equal to one of the larger parts and the reverse concepts also.

7 Provide a wide variety of opportunities to use fractions in real and meaningful ways with whole numbers and with other fractions. The use of fractions in connection with measuring devices is perhaps the most valuable kind of learning experience.

The same sequence of steps should be used in teaching children to work examples in which they add, subtract, multiply, and divide with fractions.

Using Cutouts to Learn about Fractions

The meanings of fractions and the methods of adding, subtracting, multiplying, and dividing with fractions are very easily learned when all new work is first presented by means of concrete objects. Cutout parts of circles are especially useful in this work. Each child can make his own fraction kit as follows.

From lightweight cardboard or stiff paper cut ten circles of equal size. For a pattern use the bottom of a No. 2½ size tin can.



Fold 2 of the 10 circles into halves. Fold 2 more into halves then into fourths. Fold 2 more into halves then into fourths and finally into eighths.

TERMS USED IN FRACTIONS

$\frac{3}{4}$ Numerator
Denominator

The number below the line—the *denominator*—shows the number of equal parts into which the object is divided. The number above the line—the *numerator*—tells the number of parts taken from the object. The numerator and denominator together are called the *terms* of the fraction.



A. WHOLE NUMBER



B. PROPER FRACTION



C. IMPROPER FRACTIONS



D. MIXED NUMBER

A. Numbers such as 4 and 1 are called *whole numbers* to distinguish them from fractions.

B. In *proper fractions* the numerator is smaller than the denominator. The value of a proper fraction is always less than 1.

C. In *improper fractions* the numerator is equal to, or larger than, the denominator, as $\frac{4}{4}$ or $\frac{5}{4}$. An improper fraction is equal to 1 or more than 1.

D. A *mixed number*, such as $2\frac{1}{2}$, consists of a whole number and a fraction.

Separate the folded circles into fractional parts by cutting along the folds. There will then be 4 whole circles, 4 half circles, 8 quarter circles, and 16 eighth circles. Place these circles and parts of circles in a large envelope.

Let us now see how to use these cutouts to make some discoveries about fractions:

Lay half circles on a whole circle. How many halves make a whole? In the same way, find out how many fourths make a whole circle; how many eighths. $1 = \frac{2}{2}$; $1 = \frac{4}{4}$.

Lay a half circle on a whole circle. How many quarter circles are needed to cover this half circle? How many eighths? $\frac{1}{2} = \frac{2}{4}$; $\frac{1}{2} = \frac{4}{8}$.

Lay three $\frac{1}{4}$ circles on a whole circle. How many eighths are needed to cover this $\frac{3}{4}$ circle? $\frac{3}{4} = \frac{6}{8}$.

Lay four $\frac{1}{8}$ circles on a whole circle. How many $\frac{1}{4}$ circles will exactly cover $\frac{4}{8}$ circle? How many $\frac{1}{2}$ circles? $\frac{4}{8} = \frac{2}{4}$.

Take one of each of the different parts. Show which part is greater, $\frac{1}{2}$ or $\frac{1}{4}$; $\frac{1}{2}$ or $\frac{1}{8}$; $\frac{1}{4}$ or $\frac{1}{8}$. Arrange the three parts in order of their size.

Change $\frac{1}{2}$ to fourths, to eighths. Can you change $\frac{1}{4}$ to halves? to eighths?

Can you change $\frac{3}{8}$ to halves? to fourths?

Find which is more: $\frac{1}{4}$ or $\frac{3}{8}$; $\frac{1}{2}$ or $\frac{3}{8}$; $\frac{3}{4}$ or $\frac{5}{8}$; $\frac{1}{2}$ or $\frac{3}{4}$. Tell how much more in each case.

Show $1\frac{1}{2}$ circles. Now change the whole circle to 2 half circles. You now have 3 half circles: $1\frac{1}{2} = \frac{3}{2}$.

Show that $1\frac{1}{2} = \frac{3}{2}$; that $2\frac{1}{8} = 1\frac{2}{8}$.

Show that $\frac{3}{4} = 1\frac{1}{4}$.

Show that $\frac{7}{4} = 1\frac{3}{4}$; that $\frac{9}{8} = 1\frac{1}{8}$.

Show that $1\frac{2}{3} = 1\frac{2}{3}$; that $1\frac{4}{8} = 1\frac{1}{2}$.

Show that $2 = 1\frac{2}{2}$; that $3 = 2\frac{1}{2}$.

Use cutouts to find out whether the following statements are true:

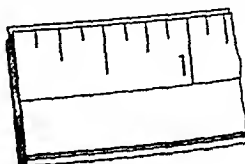
$$\frac{1}{2} = \frac{2}{4} \quad \frac{4}{8} = \frac{1}{2} \quad \frac{2}{8} = \frac{1}{4} \quad \frac{6}{8} = \frac{3}{4}$$

In the upper grades, cutouts of thirds, sixths, and twelfths can be used when studying these fractions. Fractional parts of different sizes can be purchased at many toy shops and from school-supply houses.

Using Fractions on a Ruler

Let us use the piece of ruler at the right to learn more about the use of fractions. Check your answers by using a real ruler.

Find $\frac{1}{8}$ inch; $\frac{1}{4}$ inch; $\frac{1}{2}$ inch; $\frac{3}{4}$ inch; $\frac{7}{8}$ inch. Which is longest: $\frac{1}{2}$ inch; $\frac{1}{4}$ inch; or $\frac{1}{8}$ inch?



Which is shortest?

How many $\frac{1}{4}$ inches are there in an inch? in $\frac{1}{2}$ inch? in $\frac{3}{4}$ inch?

How many $\frac{1}{8}$ inches are there in 1 inch? in $\frac{1}{2}$ inch? in $\frac{1}{4}$ inch? in $\frac{3}{4}$ inch? in $\frac{7}{8}$ inch?

Show that $\frac{1}{4}$ inch + $\frac{1}{4}$ inch = $\frac{2}{4}$ inch, or $\frac{1}{2}$ inch. Show that $\frac{1}{8}$ inch + $\frac{3}{8}$ inch = $\frac{4}{8}$ inch, or $\frac{1}{2}$ inch.

How long is the piece of ruler?

Show that the following are correct:

$$\frac{2}{4} + \frac{1}{4} = \frac{3}{4}$$

$$\frac{1}{4} + \frac{3}{4} = \frac{4}{4} = 1$$

$$\frac{1}{2} + \frac{1}{2} = \frac{2}{2} = 1$$

$$\frac{5}{8} + \frac{1}{8} = \frac{6}{8} = \frac{3}{4}$$

$$\frac{1}{2} + \frac{1}{4} = \frac{3}{4}$$

$$\frac{1}{8} + \frac{1}{4} = \frac{3}{8}$$

$$1 - \frac{1}{2} = \frac{1}{2}$$

$$1 - \frac{1}{4} = \frac{3}{4}$$

$$\frac{3}{4} - \frac{1}{4} = \frac{2}{4} = \frac{1}{2}$$

$$\frac{5}{8} - \frac{1}{8} = \frac{4}{8} = \frac{1}{2}$$

Fractions Having Equal Values

We can use the drawings below to show that differing fractions may have the same value. The circles are equal in size, and so we can compare their parts. Half of each circle is shaded.

A $\frac{1}{2}$ B $\frac{2}{4}$ C $\frac{4}{8}$ D $\frac{8}{16}$

Which drawings show that $\frac{8}{16} = \frac{1}{2}$? that $\frac{4}{8} = \frac{1}{2}$? that $\frac{2}{4} = \frac{1}{2}$? Use your cutouts to show that $\frac{4}{8}$, $\frac{2}{4}$, and $\frac{1}{2}$ are equal fractions.

Which drawings show that $\frac{1}{4} = \frac{2}{8}$? that $\frac{1}{8} = \frac{1}{8}$? that $\frac{2}{8} = \frac{1}{4}$? that $1 = \frac{8}{8}$? that $1 = \frac{4}{4}$? that $1 = \frac{16}{16}$? Use your cutouts to show that $\frac{2}{8}$, $\frac{1}{4}$, and $\frac{1}{8}$ are equal fractions.

EACH PUPIL HAS HIS OWN FRACTION KIT



With these cutouts children first learn the meaning of fractions and then the four fundamental processes

Use the drawings at the right to find the missing numerators below

$$1 = 3 \quad \frac{1}{2} = \frac{\quad}{6} \quad \frac{2}{3} = \frac{\quad}{6}$$

$$\frac{2}{6} = \frac{\quad}{3} \quad 1 = \frac{\quad}{6} \quad \frac{1}{3} = \frac{\quad}{6}$$

$$\frac{4}{6} = \frac{\quad}{3} \quad \frac{3}{6} = \frac{\quad}{2}$$

Use the four drawings of circles on the opposite page to arrange the four fractions in each group below in order of their value placing the fractions of smallest value first

$$\frac{1}{4} \quad \frac{1}{2} \quad \frac{1}{16} \quad \frac{1}{8} \quad \frac{2}{4} \quad \frac{2}{16} \quad \frac{2}{8} \quad \frac{2}{2}$$

You can see that when several fractions have the same numerator the larger the denominator the smaller is the value of the fraction

Two Golden Rules of Fractions

Rule I Dividing both terms of a fraction by the same number does not change the value of the fraction

The circles on the preceding page show us that $\frac{4}{8} = \frac{1}{2}$. We can change $\frac{4}{8}$ to $\frac{1}{2}$ by dividing both 4 and 8 by 4 as shown at the right. In the same way we can change $\frac{2}{4}$ to $\frac{1}{2}$ by dividing both terms by 2.

When we change $\frac{1}{2}$ to $\frac{1}{2}$ we say that the fraction is reduced to lowest terms because both figures in $\frac{1}{2}$ cannot be divided by any whole number other than 1.

Rule II Multiplying both terms of a fraction by the same number does not change the value of a fraction

We know that $\frac{1}{2} = \frac{1}{2}$. To change $\frac{1}{2}$ to $\frac{4}{4}$ we multiply both terms by 2 as shown at the right. In the same way we can change $\frac{1}{2}$ to $\frac{2}{2}$ by multiplying both terms by 2.

Cutouts and Diagrams Make Examples Meaningful. Research shows that manipulative materials and visual aids are of definite value in teaching children

operations with fractions. The examples below show how cutouts may be used to make clear the steps taken when we add subtract multiply or divide

ADDITION

$$\begin{array}{r} \bigcirc \\ + \bigcirc \\ \hline \bigcirc = \bigcirc \end{array} \quad \begin{array}{r} \frac{1}{4} \\ + \frac{1}{4} \\ \hline \frac{2}{4} = \frac{1}{2} \end{array}$$

1 Lay $\frac{1}{2}$ circle on the table. Below it place another $\frac{1}{2}$ circle. Now join the parts of the circle as shown in the drawing above. 1 quarter and 1 quarter are 2 quarters or $\frac{2}{4}$. This is the same as $\frac{1}{2}$ circle.

Rule To add two like fractions add the numerators of the two fractions. Write this sum over the denominator. Then reduce the fraction to its lowest terms as shown in Rule I above.

$$\begin{array}{r} \bigoplus \\ + \bigoplus \\ \hline \bigoplus = \bigoplus \end{array} \quad \begin{array}{r} \frac{3}{4} \\ + \frac{3}{4} \\ \hline \frac{6}{4} = \frac{4}{4} + \frac{2}{4} = 1\frac{1}{2} \end{array}$$

2 Lay out quarter circles showing $\frac{3}{4}$ and $\frac{3}{4}$. Join them as shown in the drawing above. Then use your circles to show that $\frac{3}{4}$ circles = $1\frac{1}{2}$ circles.

$$\begin{array}{r} \bigcirc \bigcirc \\ + \bigcirc \bigcirc \\ \hline \bigcirc \bigcirc \bigcirc = \bigcirc \bigcirc \bigcirc \end{array} \quad \begin{array}{r} \frac{1}{2} \\ + \frac{1}{2} \\ \hline \frac{2}{2} = 1 \end{array}$$

3 Use your cutouts to show the drawing above. Then use the drawing to explain the example.

$$\begin{array}{r} \bigoplus \\ - \bigoplus \\ \hline \bigoplus = \bigoplus \end{array} \quad \begin{array}{r} \frac{3}{4} \\ - \frac{1}{4} \\ \hline \frac{2}{4} = \frac{1}{2} \end{array}$$

1 Place 3 quarter circles on the table as shown in A. Then take away $\frac{1}{4}$ circle as shown in B. C shows the $\frac{2}{4}$ circle that remains or $\frac{1}{2}$ circle. $\frac{3}{4} - \frac{1}{4} = \frac{2}{4}$.

$$\begin{array}{r} \bigcirc = \bigoplus \\ - \bigoplus \\ \hline \bigoplus = \bigoplus \end{array} \quad \begin{array}{r} 1 = \frac{4}{4} \\ - \frac{1}{4} = \frac{3}{4} \end{array}$$

Rule To subtract two like fractions subtract their numerators and write the result over their denominator.

2 Use your cutouts to show the solution of the example $1 - \frac{1}{4} = \frac{3}{4}$. Explain each step shown in the drawing. In this example we cannot subtract $\frac{1}{4}$ until we change 1 to $\frac{4}{4}$. $\frac{4}{4} - \frac{1}{4} = \frac{3}{4}$.

3. How much is $3\frac{1}{4} - 1\frac{3}{4}$? Use your cutouts to show $3\frac{1}{4}$ circles. Next show how to change the $3\frac{1}{4}$ circles to $2\frac{5}{4}$ circles so that you can subtract $1\frac{3}{4}$ circles. Now take away $1\frac{3}{4}$ circles.

$$\begin{array}{rcl} \text{A} & \text{B} & \text{C} \\ \bigcirc \bigcirc \bigcirc \bigcirc & = \bigcirc \bigcirc \bigoplus \bigcirc & 3\frac{1}{4} = 2\frac{5}{4} \\ & = \bigcirc \bigcirc \bigoplus \bigoplus & - 1\frac{3}{4} = 1\frac{3}{4} \\ & \bigcirc \bigoplus \bigoplus & 1\frac{2}{4} = 1\frac{1}{2} \end{array}$$

Use the diagram above to explain each step in the example.

MULTIPLICATION

$$\bigcirc \bigcirc \bigcirc \bigcirc = \bigcirc \bigcirc = \bigcirc \bigcirc$$

$4 \times \frac{1}{2}$ means: How much are $4 \frac{1}{2}$'s? With cutouts, prove that $\frac{1}{2} + \frac{1}{2} + \frac{1}{2} + \frac{1}{2} = 2$. So $4 \times \frac{1}{2} = 2$.

In the same way, use cutouts to find $2 \times 1\frac{1}{4}$.

Use your cutouts to show that $\frac{1}{2} \div \frac{1}{4} = \frac{1}{2}$.

DIVISION

$$\bigcirc = \bigtriangleup \bigtriangleup$$

The example $1 \div \frac{1}{4}$ means: How many $\frac{1}{4}$'s can you take out of 1? Use your cut-out circles to show that $1 \div \frac{1}{4} = 4$.

Use your cutouts to find $3 \div 1\frac{1}{2}$ —that is, how many $1\frac{1}{2}$'s you can take out of 3.

A Graded Series of Teaching Units

Let us suppose that children have had many experiences in which they used fractions. Now they are ready to learn how to work examples in which they add, subtract, multiply, and divide. In each process learning must proceed in a series of carefully graded steps. The development for each process should be broken down into a series of teaching units, as explained below.

TEACHING UNITS—ADDITION

Unit 1. Easy like fractions:

$$\begin{array}{r} \frac{1}{3} \\ + \frac{1}{3} \\ \hline \frac{2}{3} \end{array}$$

Addition of two like fractions. The sum, $\frac{2}{3}$, is already expressed in lowest terms.

$$\begin{array}{r} \frac{1}{4} \\ + \frac{1}{4} \\ \hline \frac{2}{4} = \frac{1}{2} \end{array}$$

Addition of two like fractions. The sum, $\frac{2}{4}$, is not expressed in lowest terms. So we change $\frac{2}{4}$ to $\frac{1}{2}$ by dividing both terms by 2.

$$\begin{array}{r} 3\frac{1}{4} \\ + 2\frac{1}{4} \\ \hline 5\frac{2}{4} = 5\frac{1}{2} \end{array}$$

Addition of two mixed numbers. The $\frac{2}{4}$ in the sum must be reduced to $\frac{1}{2}$, as in the example above.

Unit 2. Like fractions with sums containing improper fractions:

$$\begin{array}{r} \frac{2}{3} \\ + \frac{2}{3} \\ \hline \frac{4}{3} = 1\frac{1}{3} \end{array}$$

The sum is an improper fraction, $\frac{4}{3}$. Because $\frac{3}{3} = 1$, we must change the $\frac{4}{3}$ to $1\frac{1}{3}$. Think: $\frac{3}{3} = 3 \overline{) 4} = 1\frac{1}{3}$.

Unit 3. Easy unlike fractions:

Unlike fractions must first be changed to like fractions. In the examples below, one denominator only must be changed.

$$\begin{array}{r} \frac{1}{2} = \frac{2}{4} \\ + \frac{1}{4} = \frac{1}{4} \\ \hline \frac{3}{4} \end{array}$$

$$\begin{array}{r} 3\frac{1}{8} = 3\frac{1}{8} \\ + 2\frac{3}{4} = 2\frac{6}{8} \\ \hline 5\frac{7}{8} \end{array}$$

$$\begin{array}{r} \frac{1}{2} = \frac{4}{8} \\ + \frac{7}{8} = \frac{7}{8} \\ \hline \frac{11}{8} = 1\frac{3}{8} \end{array}$$

Units 1, 2, and 3 are usually taught in the fifth grade and Unit 4 in grades six and seven. In Unit 4, we must first find the denominator to which the two fractions must be changed in order to be added.

Unit 4. More difficult unlike fractions:

$$\begin{array}{r} \frac{1}{2} = \frac{3}{6} \\ + \frac{1}{3} = \frac{2}{6} \\ \hline \frac{5}{6} \end{array}$$

Because 6, which is 3×2 , will contain both denominators 2 and 3, change both fractions to sixths. The common denominator 6 is found by multiplying the two denominators.

$$\begin{array}{r} \frac{5}{6} = \frac{10}{12} \\ + \frac{3}{4} = \frac{9}{12} \\ \hline \frac{19}{12} = 1\frac{7}{12} \end{array}$$

Here we can use either 12 or 24 as the common denominator. We call 12 the *least common denominator* (LCD).

TEACHING UNITS—SUBTRACTION

Unit 1. Subtraction of like fractions, involving no borrowing or regrouping:

The skills used in this unit are similar to those explained in detail above in the addition of fractions.

$$\begin{array}{r} \frac{2}{3} \\ - \frac{1}{3} \\ \hline \frac{1}{3} \end{array}$$

$$\begin{array}{r} \frac{3}{4} \\ - \frac{1}{4} \\ \hline \frac{2}{4} = \frac{1}{2} \end{array}$$

$$\begin{array}{r} 5\frac{2}{3} \\ - 1\frac{1}{3} \\ \hline 4\frac{1}{3} \end{array}$$

$$\begin{array}{r} 6\frac{7}{8} \\ - 2\frac{5}{8} \\ \hline 4\frac{2}{8} = 4\frac{1}{4} \end{array}$$

Unit 2. Regrouping in subtracting like fractions:

$$\begin{array}{r} 1 = \frac{4}{4} \\ - \frac{1}{4} = \frac{1}{4} \\ \hline \frac{3}{4} \end{array}$$

$$\begin{array}{r} 1\frac{1}{4} = \frac{5}{4} \\ - \frac{3}{4} = \frac{3}{4} \\ \hline \frac{2}{4} = \frac{1}{2} \end{array}$$

$$\begin{array}{r} 5\frac{1}{3} = 4\frac{2}{3} \\ - 3\frac{2}{3} = 3\frac{2}{3} \\ \hline 1\frac{3}{3} = 2 \end{array}$$

In these examples, the upper number had to be changed before it was possible to subtract.

Unit 3 Subtracting halves fourths and eighths

$$\begin{array}{r} \frac{1}{2} = \frac{2}{4} \\ \frac{1}{4} = \frac{1}{4} \\ \hline \frac{1}{4} \end{array} \quad \begin{array}{r} \frac{2}{8} = \frac{2}{8} \\ \frac{1}{8} = \frac{1}{8} \\ \hline \frac{1}{8} \end{array} \quad \begin{array}{r} \frac{3}{4} = \frac{3}{4} \\ \frac{1}{4} = \frac{1}{4} \\ \hline \frac{2}{4} = \frac{1}{2} \end{array}$$

Unit 4 Subtracting other unlike fractions

$$\begin{array}{r} \frac{1}{2} = \frac{3}{6} \\ \frac{1}{3} = \frac{2}{6} \\ \hline \frac{1}{6} \end{array} \quad \begin{array}{r} \frac{2}{3} = \frac{4}{6} \\ \frac{1}{6} = \frac{1}{6} \\ \hline \frac{1}{2} \end{array} \quad \begin{array}{r} \frac{1}{4} = \frac{2}{8} \\ \frac{1}{8} = \frac{1}{8} \\ \hline \frac{1}{8} \end{array}$$

TEACHING UNITS—MULTIPLICATION

Unit 1 Multiplying fractions and whole numbers

$$2 \times \frac{1}{3} = \frac{2 \times 1}{3} = \frac{2}{3} \quad 6 \times \frac{2}{3} = \frac{6 \times 2}{3} = \frac{12}{3} = 4$$

$$2 \times \frac{1}{4} = \frac{2 \times 1}{4} = \frac{2}{4} = \frac{1}{2} \quad \frac{1}{4} \times 3 = \frac{1 \times 3}{4} = \frac{3}{4}$$

RULE To multiply a fraction by a whole number multiply the numerator of the fraction by the whole number. Express the answer in simplest form. Use addition of fractions to show that the answers above are correct. For example $2 \times \frac{1}{4}$ is the same as $\frac{1}{4} + \frac{1}{4}$.

Unit 2 Multiplying mixed numbers and whole numbers

$$\begin{array}{r} 5\frac{1}{2} \\ \times 2 \\ \hline 10\frac{2}{2} \end{array} \quad \begin{array}{r} 4 \\ \times 3\frac{1}{6} \\ \hline 12\frac{2}{3} \end{array} \quad \begin{array}{r} 5 \\ \times 2\frac{1}{2} \\ \hline 10\frac{5}{2} \end{array}$$

Unit 3 Multiplying fractions

$$\frac{1}{2} \times \frac{1}{4} = \frac{1 \times 1}{2 \times 4} = \frac{1}{8} \quad \frac{2}{3} \times \frac{3}{4} = \frac{2 \times 3}{3 \times 4} = \frac{6}{12} = \frac{1}{2}$$

RULE To multiply two fractions first multiply the two numerators to get the numerator of the answer then multiply the two denominators to get the denominator of the answer. When necessary reduce the fraction in the answer to lowest terms.

Unit 4 Multiplying fractions and mixed numbers

$$\frac{1}{2} \times 1\frac{1}{4} = \frac{1}{2} \times \frac{5}{4} = \frac{1 \times 5}{2 \times 4} = \frac{5}{8}$$

$$\frac{3}{4} \times 1\frac{1}{3} = \frac{3}{4} \times \frac{4}{3} = \frac{3 \times 4}{4 \times 3} = \frac{12}{12} = 1$$

RULE To multiply a mixed number or fraction by a mixed number first change the mixed numbers to improper fractions. Then multiply as in Unit 3.

TEACHING UNITS—DIVISION

In division of fractions the final step requires the process of multiplication.

Unit 1 Division of whole numbers by fractions

$$1 \div \frac{1}{4} = 4$$

$$\text{Step I } 1 \times$$

Change \div to \times

$$\text{Step II } 1 \times \frac{4}{1}$$

Invert the divisor $\frac{1}{4}$

$$\text{Step III } \frac{1 \times 4}{1} = \frac{4}{1} = 4 \quad \text{Multiply as in multiplying with fractions}$$

RULE To divide a whole number by a fraction (I) change the \div sign to the \times sign (II) invert (tip upside down) the fraction (III) multiply as in multiplying whole numbers and fractions. See Unit 3 under Multiplication on the same page.

Apply this rule to the following examples.

$$2 \div \frac{3}{4} = 2 \times \frac{4}{3} = \frac{2 \times 4}{3} = \frac{8}{3} = 2\frac{2}{3}$$

$$2 \div \frac{4}{5} = 2 \times \frac{5}{4} = \frac{10}{4} = 2\frac{3}{4}$$

Unit 2 Division of fractions and mixed numbers by fractions

$$\frac{1}{2} \div \frac{1}{4} = \frac{1}{2} \times \frac{4}{1} = \frac{4}{2} = 2$$

$$\frac{3}{8} \div \frac{3}{8} = \frac{3}{8} \times \frac{8}{3} = \frac{12}{24} = \frac{1}{2}$$

$$\frac{3}{4} \div \frac{5}{6} = \frac{3}{4} \times \frac{6}{5} = \frac{18}{20} = \frac{9}{10}$$

$$2\frac{1}{4} \div \frac{2}{3} = \frac{9}{4} \times \frac{3}{2} = \frac{27}{8} = 3\frac{3}{8}$$

In each example the divisor was inverted. In the last example the mixed number $2\frac{1}{4}$ was changed to the improper fraction $\frac{9}{4}$ and the work was then completed as in the first three examples.

Unit 3 Division of whole numbers and mixed numbers by mixed numbers

$$4 \div 1\frac{1}{2} = 4 \div \frac{3}{2} = 4 \times \frac{2}{3} = \frac{8}{3} = 2\frac{2}{3}$$

$$4\frac{1}{2} \div 1\frac{1}{2} = \frac{9}{2} \div \frac{3}{2} = \frac{9}{2} \times \frac{2}{3} = \frac{18}{6} = 3$$

RULE When dividing by a mixed number, first change the mixed number to an improper fraction then invert the divisor and multiply as in Units 1 and 2.

Unit 4 Division of fractions and mixed numbers by whole numbers

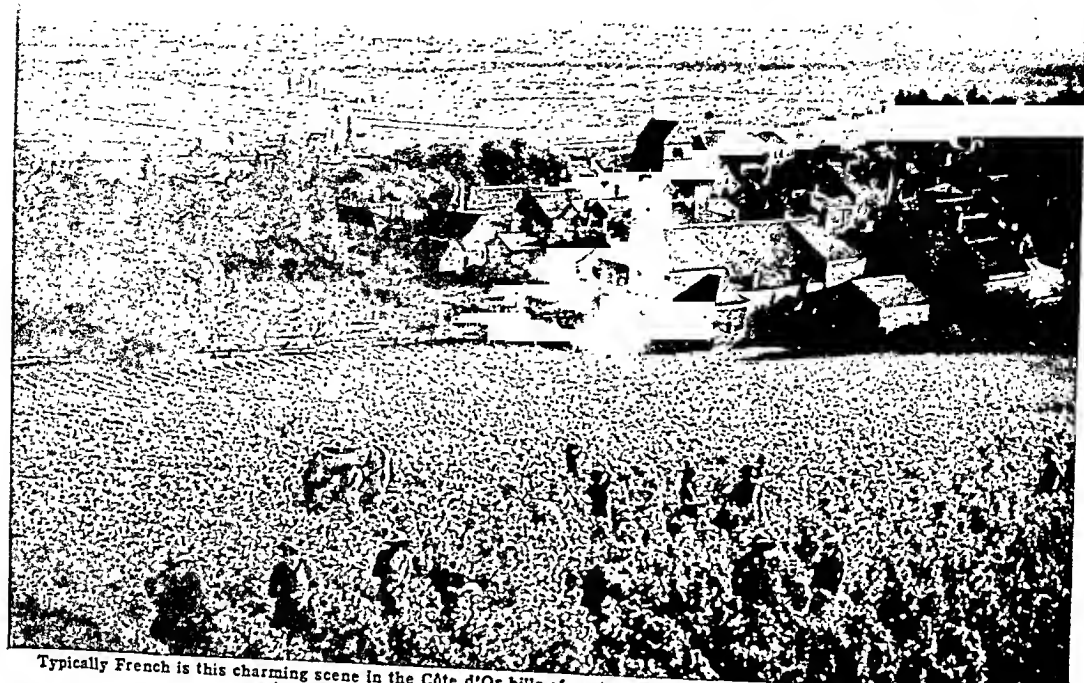
$$\frac{1}{4} \div 2 = \frac{1}{4} \div \frac{2}{1} = \frac{1}{4} \times \frac{1}{2} = \frac{1}{8}$$

$$1\frac{1}{2} \div 3 = \frac{3}{2} \div 3 = \frac{3}{2} \times \frac{1}{3} = \frac{3}{6} = \frac{1}{2}$$

Check your answers by multiplication. When possible use your cutouts to find the answer.

Copy the examples in each set above and work them with the book closed. Then compare your work with the solutions given to see whether your answers are correct. For more practice use the exercises in a good arithmetic textbook.

The WEALTH, BEAUTY, and CULTURE of FRANCE



Typically French is this charming scene in the Côte d'Or hills of eastern France—a sunny hillside covered with vineyards, a tree-shaded village, and in the distance grain fields on a flat plain.

FRANCE. When the Germans were driven out of Paris in August 1944, a proud nation was reborn. Remembering her long history as a great power, France was determined to assume once more an important rôle in world affairs. For this rôle her geographical position fitted her.

Situated at the crossroads of western Europe, France is the least isolated of the great nations. To the north Great Britain is her close neighbor. To the east, Belgium, Germany, Switzerland, and Italy lie at her gates. To the south she faces Spain. A bare day's sail separates her from Africa; and the sea route to the near East and the Suez Canal passes her southern shores.

Bordering both on the Mediterranean and on the Atlantic and touching on the North Sea, France belongs equally to southern and northern Europe. When Rome was the center of the civilized world, Gaul—as France was then called—was a notable part of her empire. When medieval Venice and Genoa controlled the world's commerce, the French were close at hand to play their part. Then, when the scene of power shifted from south to north, turning men's eyes away from the "middle sea" to the Atlantic, France re-

Extent.—North to south, about 600 miles; east to west, 400 to 570 miles. Coast line: English Channel, 672 miles; Atlantic, 831 miles; Mediterranean, 369 miles. Area (including Corsica), 212,659 square miles. Population (1954 census), 42,734,445.

Natural Features.—Alps (Mont Blanc, 15,781 feet), Pyrenees, Jura, Meuse, and Moselle rivers; the Rhine now forms part of the eastern boundary. Climate, temperate; semitropical on south coast.

Products.—Textiles (cotton, woolen, linen, silk), laces, clothing, objects of art and fashion; coal, machinery, iron and steel, porcelain, glass, and chemicals; wines and cider; grains, potatoes, sugar.

Principal Cities.—Paris (capital, 2,820,534); Marseilles (605,577); Lyons (462,657); Bordeaux, Toulouse, Nice (over 200,000); Nantes, Strasbourg, Lille, Saint-Etienne, Le Havre, Toulon, Nancy, Reims, Rouen, Rennes, Grenoble, Roubaix, Brest (over 100,000).

In French Union.—Algeria; Associated States (Indo-China, Morocco, Tunisia); Overseas Departments (Martinique, Guadeloupe, Réunion, Guiana); Overseas Territories (French West Africa, French Equatorial Africa, Madagascar, French Somaliland, Comoro Archipelago, Settlements in Oceania, New Caledonia, St. Pierre, Miquelon); Trustships (Togoland, Cameroons).

tained the importance which was lost by other Mediterranean lands.

A Blend of Many Races

It is only natural that in a region so open to the world we should find a varied racial mixture. Traces of several important prehistoric races are still evident in southern France. At the dawn of recorded history most of France was inhabited

by the Gauls, a people of Celtic blood. In the southeast lived the Ligurians, of the same race as the ancient dwellers in northern Italy; and in the southwest the Iberians, probably survivors of a widespread race who had inhabited western Europe before the coming of the Celts.

Phoenician merchants settled at a very early date on the Mediterranean coast. About 600 B.C. Greek traders founded the colony of Massalia (modern Marseilles), and rapidly extended their commerce far into the interior. Then in the succeeding centuries came the Roman conquerors, under whom Gaul became thoroughly Romanized. The invasion of the Germanic tribes followed—Visigoths, Burgundians, and Franks. The Franks gave the land their own name and exercised a dominant influence that was never over-



The Pyrenees are a high barrier to the Spanish border, and in the east mountains are seen in the long valley of the Rhone that leads to the Mediterranean. The other great river flows to the Atlantic through rolling hills and broad fertile valleys.

thrown Moors from Spain settled for a time north of the Pyrenees and exercised a fleeting rule. Fair-haired Northmen from Scandinavia made their homes along the English Channel and became the Normans. All these later settlers were more or less absorbed by the original Gallo-Roman population, but some of them worked profound changes in the customs and physical appearance of the native inhabitants. To these influences must be added those brought in by later immigrations of Italians, Spaniards, Germans, Dutch, and other peoples reflected in nearly any list of representative French names. France presents to this day marked differences in the types of her people. In Normandy, for instance,

we find the tall blue-eyed light-haired descendants of the Viking Northmen. In the southern provinces—Gascony, Languedoc, and Provence—the short dark-haired pre-Celtic type prevails. In Brittany we have people of purest Celtic descent still speaking a Celtic tongue. On the north slopes of the Pyrenees live descendants of the ancient Iberians called the Basques who have kept alive a language whose origin is largely a mystery.

But All Are Devoted to France

Despite these reminders of a varied origin the people of France are bound together by strong national ties and a devotion to a common heritage. The Gallic melting pot has fused the diverse elements. The

glories and disasters of a stirring and eventful history have welded and forged and tempered them into a nation whose power and vitality have more than once astonished the world.

One of the most frequently remarked characteristics of the French people is hard-headed thrift, typified by the peasant landowner. "Jacques Bonhomme" ("Goodman James"), as he is nicknamed, is the backbone of the nation, and he is so strongly attached to the soil of his forefathers that he has never followed the example of other Europeans in emigrating in considerable numbers to foreign lands.

Since the French Revolution the land has been divided among a great many small owners, and the laws of inheritance tend to perpetuate these small holdings. The peasant ownership of the soil promotes hard work and thrift on the one hand, and on the other the spirit of independence which comes to the man who "works for himself." Socialism, long popular in French industrial centers, was invariably opposed by the French farmer, who clung to private ownership. Though a strong follower of tradition, "Jacques Bonhomme" is primarily an individ-

ualist who wants to be allowed to manage his own affairs in his own way.

Roman Catholicism is the prevailing faith of the French people, but religious instruction in the public schools is strictly forbidden.

French Coasts and Harbors

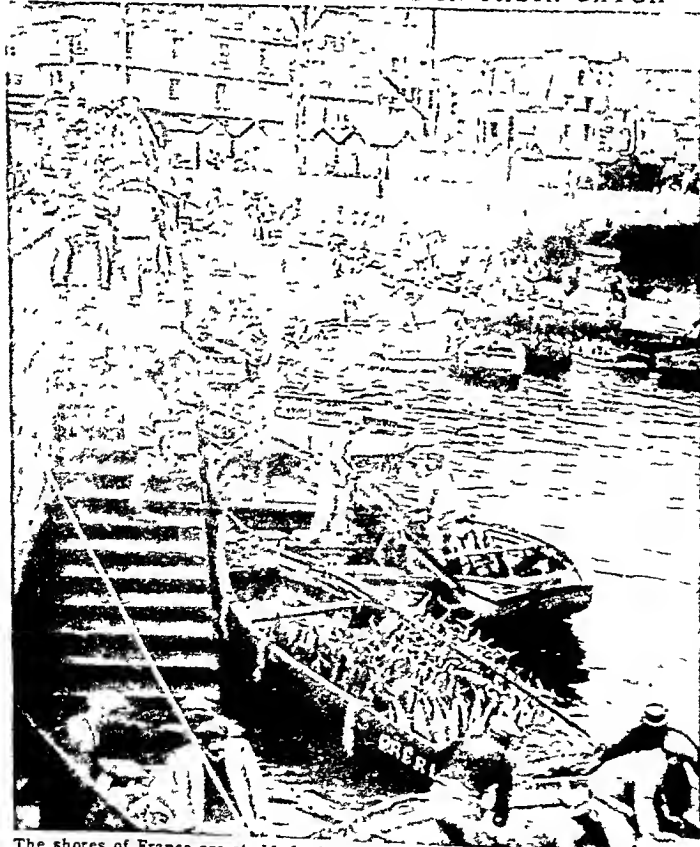
France is shaped roughly like a pentagon, a five-sided figure. Its apex reaches to the North Sea. The Pyrenees Mountains and the Mediterranean make up the base. The Atlantic and the English Channel form the western and northwestern sides. Belgium, Luxembourg, and part of Germany lie to the northeast, and Switzerland and Italy to the east. France is somewhat smaller than the state of Texas. Its greatest length north to south is about 600 miles; the greatest width, about 570 miles. The island of Corsica, which lies more than 100 miles from the mainland coast in the Mediterranean, is an integral part of France (see Corsica). Algeria, the richest overseas member of the French Union, has elected its own Assembly since 1948; but France appoints the governor general.

The western coast line of France shows two pronounced land projections—the Norman peninsula (called "Cotentin"), which reaches out into the English Channel, with Cherbourg at its head; and the rock-bound peninsula of Brittany, with the thriving maritime city of Brest near its westernmost point. In the angles between the Norman and the Breton peninsulas lie the famous Channel Islands—Jersey, Guernsey, Alderney, and Sark—which belong to England.

The broad sweeping curve of coast between Brittany and Spain encloses the Bay of Biscay. The French usually call its lower angle the Gulf of Gascony. The deep, crescent-shaped depression in the coast of Languedoc, on the Mediterranean, is called the Gulf of the Lion.

The seacoasts of France are for the most part either dangerously rocky or low and sandy. There are comparatively few good harbors except up the mouths of rivers. Of these river ports the most important are Le Havre and Rouen on the Seine, St. Nazaire and Nantes on the Loire, and Bordeaux on the Garonne. The Rhone, owing to the great quantities of sediment carried down by its rapid current and the low swampy character of the delta at its branching mouth, offers no good harbor facilities. The principal seaports not situated on rivers are Cherbourg at the tip of the Norman peninsula; Brest, Dunkirk, and Calais, in the extreme north; La Rochelle in the west;

BRETON FISHERMEN BRING IN THEIR CATCH



The shores of France are studded with small communities whose principal industry is fishing but which the French people use also as vacation resorts. The one shown here is Concarneau on the southern coast of Brittany. The boat in the foreground is loaded with tunny caught off shore.

Marseilles on the Mediterranean the largest of all and Cette opposite Marseilles on the Gulf of the Lion Brest in Brittany and Toulon on the Mediterranean were developed principally as naval stations and have comparatively little commerce

Rolling Plains and Lofly Mountain Ranges

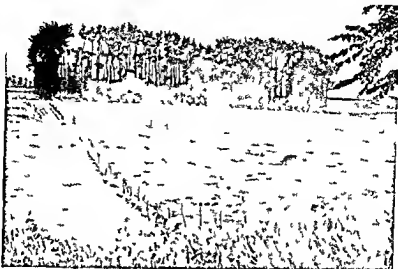
It is mostly a smiling and fertile land that the French have inherited from their ancestors. Broad plains and deep valleys plateaus and high mountain chains give the surface more varied than any other European country. In spite of this variety almost all the land can be put to some useful purpose.

Massive mountain ranges form a rampart around France on the south and east. Between the Mediterranean and the Bay of Biscay the Pyrenees rise with great abruptness. Their high crests—8 000 to 9 000 feet—mark the boundary between France and Spain (see Pyrenees). The Alps the greatest mountain range of France shelter the beautiful Mediterranean coast—the famous Riviera—then sweep north along the frontiers of Italy and Switzerland. The summit of Mont Blanc (15 781 ft.) which lies seven miles inside the French boundary is the second highest peak in Europe being surpassed only by Mount Elbrus in the Russian Caucasus. Glaciers lie on the topmost ridges of the Alps but in the low sheltered valleys which on the French side broaden into plains agriculture flourishes (see Alps).

Farther north the Jura Mountains a detached and lower branch of the Alps complete the boundary between France and Switzerland (see Jura Mountains). Northward the Vosges form a barrier against Germany. These mountains and their smaller elevations in this region drop off gently toward the west but sharply toward the east making it difficult to invade France from this direction. This explains why German armies repeatedly violated Belgium's neutrality in order to find a quick and easy route to Paris.

On the Atlantic coast rugged plateaus cover the peninsula of Normandy and Brittany with peaks reaching heights of a thousand feet. The rest of western France consists of rolling plains. The great basins of the westward flowing rivers. A line drawn from the middle of the Belgian border to Bayonne in the extreme southwest corner roughly divides these plains—less than 600 feet high—from the highlands of the east.

A DAIRY FARM IN WIND SWEEP NORMANDY



The farmers in Normandy plant trees around their houses to protect them from the strong westerly winds. Too cool and moist for grains or vegetables the soil here grows a good crop of green pastures and orchards. Here the people drink apple cider rather than the wine common to the rest of France.

In the center of France there rises out of the plains the confused mass of the Auvergne where symmetrical cones of extinct volcanoes reach heights of 600 feet. Mineral springs in this region like the famous one at Vichy have become health resorts. The Auvergne Mountains merge on the east with the Cévennes chain which runs north for 200 miles paralleling the long valley of the Rhone—the only great river of France that flows south to the Mediterranean.

The Famous Rivers of France

Four great river systems—the Rhone the Garonne the Loire and the Seine—each with numerous tributaries drain the well watered soil of France. The Rhone which carries the greatest volume of water enters France from Switzerland through the gap between the Jura and the Alps. At Lyons it picks up the waters of its great tributary the Saône and is turned sharply to the south by the bluffs of the Cévennes Mountains. The Rhone Valley from here to the Mediterranean coast is one of the most picturesque parts of France. After the second World War France began to harness the swift Rhone by building dams ship canals and hydroelectric plants (see Rhone River).

The Garonne River in the southwest gathers its waters about equally from the Pyrenees and the western slope of the Cévennes. After uniting with the Dordogne near the Atlantic coast it forms the broad estuary called the Gironde. The Loire the longest of French rivers also rises in the Cévennes southwest of Lyons. Crossing the whole breadth of central France and gathering numerous tributaries it pours into the Atlantic south of the peninsula of Brittany (see Loire River).

In northern France the Seine after collecting the waters of the Paris basin winds sluggishly across

the Norman plain and empties into the English Channel at Le Havre (see Seine River). On its chief tributary, the Marne, and on the Aisne, which flows into the Oise (another tributary of the Seine), great battles have been fought (see Aisne River; Marne River).

In addition to these four river systems, several other streams deserve mention. The little river Somme, which parallels the Seine, 50 miles to the north, was the scene of great battles in the first World War (see Somme River). In northeastern France rise the Meuse River, which flows into Belgium, and the Moselle, which enters Germany (see Meuse River). The Rhine forms part of France's eastern boundary.

All these streams are more or less navigable; and connecting as they do with a great network of canals, they form a valuable system of waterways. One of the most famous units in the system is the Canal du Midi, dating from the reign of Louis XIV, which connects the Mediterranean with the Garonne River and so with the Atlantic. Others join the Rhone, the Loire, the Seine, and the Rhine systems one to the other, so that heavy freight can be carried entirely by boat to and from every important industrial region. An extraordinary waterway is the Rhone-Marseilles Canal. At Roue it flows under the hills of la Nerthe through a tunnel about $4\frac{1}{2}$ miles long, 72 feet wide, and 50 feet high. This tunnel accommodates heavy barges carrying raw material from Marseilles to inland factories.

A Wide Variety of Crops

Winds from the Atlantic, unchecked by coastal mountain ranges, carry their moisture and moderating influence to practically the whole of France. Each section has its own characteristic products. Only in the extreme southwest, where sand, gravel, and boulders have been washed down from the Pyrenees, is there much unproductive soil.

TO THE MAID OF ORLEANS



Nearby the spot where Joan of Arc was burned at the stake in May 1431 this memorial, in the modern style, has been placed. It stands in the market place of Rouen.

Wheat is the chief cereal crop of France. Following the first World War, import restrictions, tariffs, and bureaus for the control of the growing and marketing of wheat were set up, which brought about a great increase in production. Oats rank next to wheat, and rye and barley are raised on the poorer soils of the coast and of the eastern mountain regions. Sugar beets, growing on the rich northern plains, provide the raw material for hundreds of sugar factories and refineries. Hops, flax, and hemp are also raised. Fruits and vegetables are of excellent quality, and all districts have their truck gardens. Among vegetables, potatoes take first rank, as might be expected in the land where the scientist Parmentier first popularized the potato as food by inducing King Louis XVI to wear the flower of the plant in his buttonhole. A coarse tobacco is grown in scattered regions. Its cultivation, manufacture, and sale is a government monopoly yielding a large revenue.

The Land of Wine

More wine is produced in France than in any other country. The mild cheap red or white varieties replace largely the tea and coffee of other nations. The wines of the provinces of Champagne and Burgundy, the regions about Bordeaux, the valleys of the Loire, the Rhine, and the Rhone, and the hills of Languedoc in the south are famous the world over. Wines constitute an

important export, but so much of the cheaper grades is required at home that additional quantities are imported, especially from Algeria. Cider is produced in Brittany and Normandy.

Wealth from Pastures, Forests, and Sea

The meadows of the great French plain produce quantities of beef and dairy cattle; and the northern provinces are the homes of famous breeds of draft horses—Breton, Norman, Percheron, and Flemish. The slopes of the Pyrenees are noted for their mules. Hogs thrive everywhere and sheep and goats are raised

GRAPES AND GAIETY THRIVE IN SUNNY FRANCE



Vineyards such as this one make France the leading wine producing country of the world. Fine wines are exported, but most of the output stays at home for each person in France drinks on the average a barrel of wine each year. As so typical of France is these young farm women who season hard work with a good home

in great numbers on the high pasture lands of the Cévennes the Vosges and the Jura. Poultry and eggs are marketed in all sections. Livestock production grew steadily in 1900-13 then fell drastically in the first World War. Stocks increased slowly until the second World War when German occupation cut into them. After the war excellent feed crops helped to increase production quickly, especially dairy cattle.

The forest and lumber industry of France has been developed to a very high degree but local production is far from sufficient to meet the demands of the wood consuming industries. Some lumber is exported but large quantities of softwoods are imported each year from northern Europe and America together with rarer woods from the tropics for manufacturing fine furniture. The quarries of the high lands produce plenty of stone for construction work particularly granite. The typical French farmhouse is built of stone with a thatched roof the barn also of stone and most of the old land boundaries are low stone walls.

France ranks high among fishing countries. The north coast provinces send large fleets each year to the haunts of the cod in the waters of Newfoundland and Iceland and to the herring schools of the North Sea. On the west coast oysters sardines and tunny are taken and in the Mediterranean sardines anchovies and tunny.

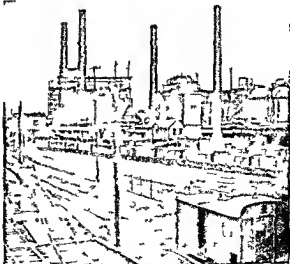
Mining and Industry

Iron and coal are mined in the northeast where France borders Belgium and Germany in the most heavily industrialized section of Europe. In the first World War France won back Alsace-Lorraine with its valuable mineral resources (see Alsace-Lorraine). Hydroelectric

power began to be developed about 1920 and compensated in part for a lack of coking coal which had to be imported from Germany. Potash was obtained from Alsace and phosphate from Algeria. In the production of bauxite (for aluminum) France soon took the lead among European countries. In heavy industry she came to rank among the foremost nations of the world. Automobiles machinery iron and steel chemical products and textile goods can be produced in great volume in the mills and factories of Lille Lyons Nancy La Creusot St Etienne and the Paris region.

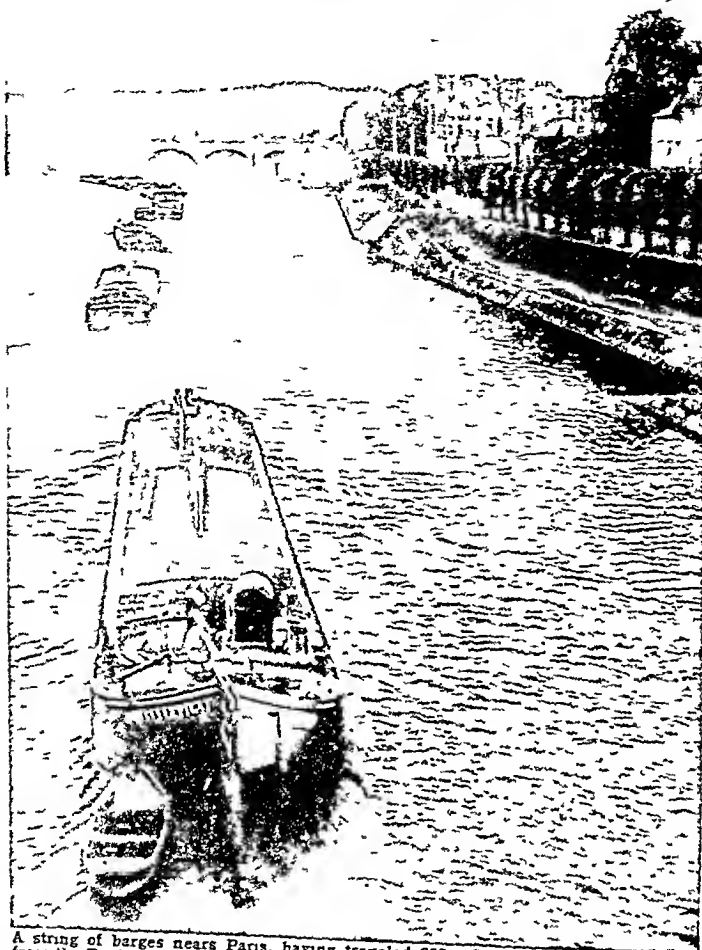
The textile industries of France are famous the world over. Lyons long famous for its natural silk fabrics now ranks first among French cities in the production of artificial silk. Normandy—particularly the city of Rouen—is noted for its cotton cloth two-thirds of the raw cotton being imported from the United States through Le Havre. Woolens which rank high among French exports are mostly manufactured in the region from Lille to Reims. Linens are made in Lille Roubaix and other northern

BLAST FURNACES AND STEEL MILLS



This steel plant at Pompey, a small town near Nancy is one of many in the Lorraine district of northeast France. In this region is concentrated most of the heavy industry of the country based on an extremely rich deposit of iron ore.

THE SEINE RIVER LINKS PARIS WITH THE SEA



A string of barges nears Paris, having traveled 200 miles up the winding Seine from the English Channel. Connected by canals with other rivers, the Seine makes Paris one of the chief ports of France. Above Rouen freight travels in barges.

towns. The laces of Normandy and Brittany, notably the hand-worked lace of Alençon (point d'Alençon), bring high prices on both sides of the Atlantic. France is distinguished also for her fine leather goods, the exquisite porcelains of Sèvres and Limoges, the cut glass of Baccarat, the jewelry made chiefly in Paris and its environs, the perfumes distilled from the flowers of her Mediterranean coast, and countless other articles of art and fashion. Most French factories are noted for the fine taste and quality of their goods rather than for quantity of production. Giant factories with modern machinery are few; but an increasing number are striving to modernize.

Until 1914 France was primarily an agricultural country. The expansion of industry following the first World War balanced her economy and made her almost self-sufficient in both food and manufactured products. The chief imports are coal and coke, raw cotton and wool, cheaper wines, cereals, and petroleum. Leading exports include chemical products, fabrics

of cotton, wool, silk, and rayon; iron and steel; fine wines; women's clothing, perfumes, jewelry, and soap.

French Life Centers in Paris

More than in any other great nation perhaps, the life of France centers in her capital. Paris is the actual heart of the nation's commerce and industry, of her social and political affairs. The wonderful system of French roads, built up and extended from the famous old Roman roads, radiate from Paris. All the great railway lines, airways, and waterways meet there, making a vast web that connects every part of France with the capital. Frenchmen who wish to play a leading part in the affairs of the nation must go to Paris. And although Paris life by no means reflects the true life of the French, it is there that political, literary, and artistic history is made. So strong is the intellectual and artistic influence of Paris that it extends far beyond the borders of France. The city has been called the "modern Athens" and the "intellectual capital of the world" (see Paris).

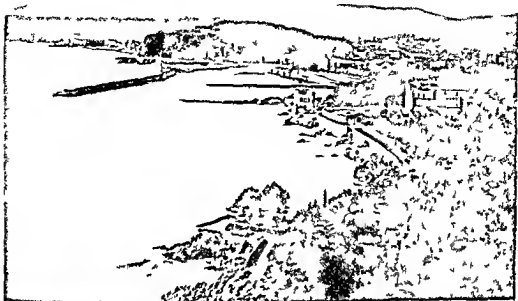
The Charm of French Culture

It has been said that every man has two countries, "his own and France." This suggests truly the charm that foreign visitors find in this smiling land. Everywhere one is reminded of France's stirring history. Perhaps it is an old walled city such as Carcassonne, whose stone towers and battlements still stand much as they were in the far-off Middle Ages.

Perhaps it is the marvelous triple-arched Roman aqueduct, flung across a river valley near Nîmes 18 centuries ago and still standing in its majestic simplicity. Or it may be the twin spires of William the Conqueror's famous Abbey church at Caen in Normandy, or the queer crooked streets of Rouen and the ancient houses that once looked down upon the procession which bore Joan of Arc to the stake. Those who have seen the great Gothic churches which, like gigantic carved jewels, dot the surface of northern France—at Amiens, Chartres, Le Mans, Reims, and Paris—can never forget their soaring grandeur. And those who have visited the famous châteaux of France—Chinon, Loches, Amboise, Chambord, Chenonceaux, Azay-le-Rideau in Touraine, and the ruins of Coucy, Gaillard, and Pierfonds elsewhere—have touched upon some of the most stirring events of French history.

Besides these great monuments of the past, France possesses in the Palace of the Louvre in Paris, and elsewhere, some of the most valuable museum collec-

TWO CHARMING BITS OF SOUTHERN FRANCE

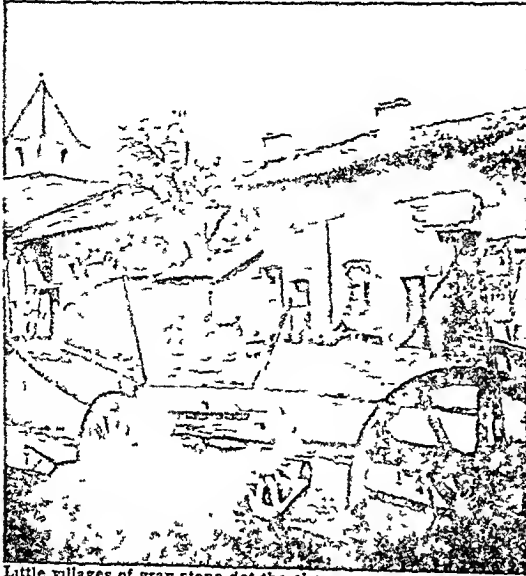


The whole coast of the Med terraced from Cannes to the Italian frontier and of beauty known as the French Riviera stretches for miles with famous resorts, quaint villages and views of great beauty. This view of the famed city of Nice captures some of the charm of this part of France. The hill in the center is the Chateau de la Sirene.



The Palace of the Popes in Avignon on the Rhone is one of the famous historical structures of southern France. It was built between 1316 and 1370 during the period when the papal seat was at Avignon.

A TYPICAL FRENCH FARMHOUSE



Little villages of gray stone dot the charming countryside. The thrifty peasant—still the backbone of France—gets a high yield from his small holdings.

tions in the world. They include immortal paintings, statues, and relics of the prehistoric Cro-Magnon people gathered from caves in southern France. This priceless heritage of art and culture attracts thousands of students from abroad. Each year throngs of tourists visit France to enjoy the gracious French mode of life. Indeed, France was so long the European center of learning and manners that French became the "second language" of well-educated foreigners and the speech of world diplomacy.

Education System

Education in France is free, and compulsory for all children between the ages of six and fourteen. The elementary schools, the *lycées* (high schools and junior colleges) and the universities form an educational system called the University of France. This system is directed by a minister of education.

France has 17 universities. The outstanding one is the University of Paris, noted as a center of European learning since the 12th century. Among other notable French universities established in the Middle Ages are Montpellier and Grenoble.

How France Is Governed

Long years of combating monarchy and trying to establish a democratic French government ended in 1870 with the adoption of a republican régime. A constitutional law enacted in 1875 named the régime the Third

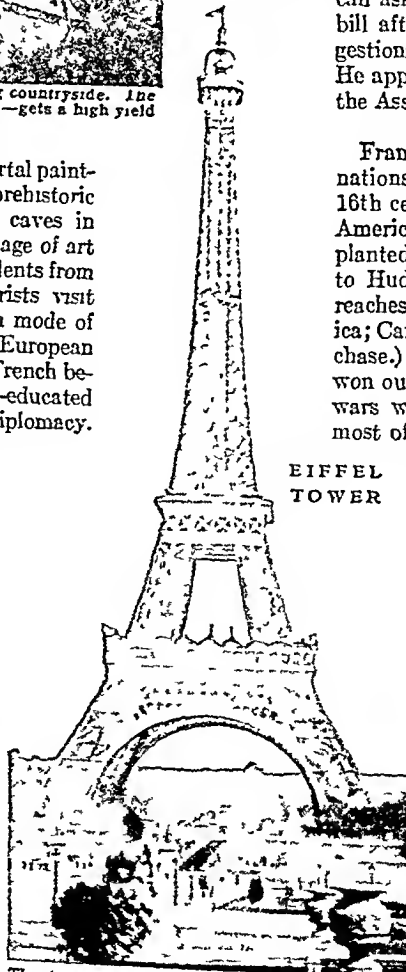
Republic. This was the law of France until the Germans conquered the country in 1940, during the second World War. They forced a dictatorship on the French, and the Third Republic ended July 11, 1940.

Freed in 1944, France in 1945 voted to create a Fourth Republic. The republic adopted its constitution on Oct. 13, 1946. The chief political divisions of the republic are *departments*, and the units of local government are *communes*. The national government is parliamentary. Parliament consists of two houses—the National Assembly and the Council of the Republic. Men and women are elected to the Assembly by nation-wide vote for a term of five years. The Council is named by an electoral college made up of departmental and communal bodies. Parliament elects the president of France. His term is seven years. He can be re-elected only once. Only the Assembly can make laws. The Council is only advisory. The president has little power. He has no veto, but he can ask the Assembly to reconsider a bill after the first reading. His suggestions are heard in the next reading. He appoints the premier but must get the Assembly's consent.

France Wins Colonies

France was one of the first modern nations to win colonies. Early in the 16th century it laid a claim to North America. In the next 150 years it planted colonies from the St. Lawrence to Hudson Bay, and along the vast reaches of the Mississippi. (See America; Canadian History, Louisiana Purchase.) Early in the 17th century it won outposts in Asia (see Asia). But wars with rival powers cost France most of its colonies.

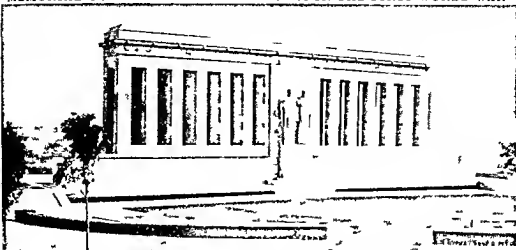
Humiliating defeat in the Franco-Prussian War of 1870 spurred France to renew its quest for riches abroad. It already held Algeria, won in 1830. Determined to expand its conquests in Africa, France soon gained Morocco, Tunis, a large part of the equatorial region, the huge west shoulder of the continent, several scattered outposts on the west coast, Somaliland in the northeast, and the giant easterly island of Madagascar. Turning to Asia, France won control of Indo-China. In the 20th century, victory in the first World War gave France mandates over Syria, the Cameroons, and parts of Togo in Africa. The Syrian



BIFFEL
TOWER

This tower, 984 feet high, was built for the Paris Exposition of 1889. It was long the world's tallest structure. From its tip tourists can view the entire city and the surrounding countryside.

MEMORIAL TO THE AMERICAN SOLDIERS IN THE FIRST WORLD WAR



This striking monument stands near Chateau Thierry on the Marne where American forces helped French soldiers to seal the German drive on Paris in July 1918. The monument was dedicated to Americans in 1937. Though highly regarded here in the second World War in 1944 the memorial was shelled.

mandate ended in 1946 when Syria became independent (See also Algeria Indo-China Madagascar Morocco Syria Tunisia)

French Union Replaces Colonial Empire

The 1946 constitution of the Fourth Republic created the French Union. It consisted of the republic and former colonies and dependencies. This new political structure gave considerable self rule to many of them, largely meeting the demand for autonomy.

The principal overseas members of the French Union are divided into (1) Associated States (2) Overseas Departments (3) Overseas Territories (4) Government-General of Algeria. All divisions and their units are listed in the table on this page.

The amount of self government varies. Viet Nam and Cambodia for example have complete self rule except in military affairs and foreign policy. The kingdom of Laos is also self governing but is subject to French counselors. Overseas Departments are administered by French prefects but elect their own assemblies. Overseas Territories are administered by French governor-generals assisted by appointed councils and elected native assemblies. All members of the Union are represented in the republic's National Assembly and Council and in the Assembly of the French Union. This Assembly is concerned with the general management of the entire French Union.

The overseas members of the French Union cover a total area of about 4,600,000 square miles. Their total population is about 77,000,000. Some nine-tenths of the area is in Africa, where France has a share in more territory than any other nation. Other overseas members are scattered throughout the world.

The Union structure of these overseas areas is a compromise. France had ruled its colonies with considerable fairness and efficiency but had done little to advance their education, living conditions or political

freedom. Many demanded full self government. But France was their best customer for exports and so most of them accepted the French Union.

The exceptions were Syria and Indo-China. When Syria became free in 1946 France lost its power in the eastern Mediterranean. In Indo-China in 1945 Annam and Tonkin formed the autonomous Viet Nam republic which France recognized. Then Viet Nam's new demands plunged Indo-China into civil war. In 1949 France let Cochinchina join Viet Nam and set up a native ruler. Viet Nam and France then joined to fight Communism in Indo-China (see Indo-China).

MEMBERS OF THE FRENCH UNION

- | | |
|-----------------------------------|----------------------------------|
| I REPUBLIC OF FRANCE | 6 New Caledonia and Dependencies |
| II ASSOCIATED STATES | 7 St. Pierre and Miquelon |
| 1 Protectorates | 8 French Equatorial Africa |
| a Morocco | a Gabon |
| b Tunisia | b Middle Congo |
| 2 Indo-China | c Oubangui-Chari |
| a Viet Nam | d Tchad |
| b Cambodia | 9 French West Africa |
| c Laos | a Senegal |
| III GOVERNMENT-GENERAL OF ALGERIA | b Mauritania |
| IV OVERSEAS DEPARTMENTS | c Guinea |
| 1 Martinique | d Sudan |
| 2 Guadeloupe | e Niger |
| 3 Réunion | f Ivory Coast |
| 4 Guiana | g Dahomey |
| V OVERSEAS TERRITORIES | h Upper Volta |
| 1 Madagascar and Dependencies | VI TERRITORIES UNDER TRUSTESHIP |
| 2 Comoro | 1 Togoland |
| 3 French Somaliland | 2 Cameroons |
| 4 French Settlements in India | VII ANGOLO-FRENCH CONDOMINIUM |
| 5 French Settlements in Oceania | New Hebrides |

Growth of France through 2,000 Years

AT the time of the Roman Conquest France was occupied by a large number of independent tribes, who were of "Mediterranean" stock (*see* Races of Mankind) and spoke various dialects of a Celtic tongue. The Romans found the conquest of these tribes no easy matter, but Julius Caesar finally overcame them and organized Roman government (58-51 B.C.). The Gauls, as the Romans called these natives, adopted the Roman dress, language, and customs. Christianity spread from Rome to Gaul and was widely accepted as early as the 4th century.

With the decline of the Roman Empire, German barbarian invaders entered Gaul. Chief among these were the Franks, who under Clovis (481-511) established Frankish rule over most of that land. His adoption of Christianity led to the conversion of all those who served him.

The Merovingian dynasty, of which Clovis was the founder, was thrust aside by a new family—the Carolingians—who had been the "Mayors of the Palace" and now gave new life to the declining Frankish state. The greatest ruler of this line was Charlemagne, whose reign belongs to world history. He became the supporter of the Christian church and was crowned Emperor of the Holy Roman Empire by the Pope in Rome on Christmas Day, 800 (*see* Charlemagne).

state when the Hundred Years' War with England (1337-1453) impoverished her and led to conditions approaching anarchy in many parts of the country. A French peasant girl, Joan of Arc, became the national heroine by turning the tide against the English, who were finally driven from the soil of France (*see* Hundred Years' War). France slowly recovered, and her kings—chiefly Louis XI (1461-83)—gradually were able to unify the nation and to centralize government in their own hands. Louis XIV (1643-1714) marked the culmination of the power of the sovereign. He was indeed "the state." His authority was envied by the sovereigns of Europe and his court was imitated (*see* Louis, Kings of France). Meanwhile Protestant (Huguenot) ideas spread in France in the time of Francis I (1515-47), and civil wars over religion followed which occupied the latter part of the 16th century. Though France had rejected Protestantism, partial toleration was granted by gallant Henry IV (1589-1610) in the Edict of Nantes (1598).

The 18th century witnessed a long struggle between England and France for colonial empire. The Treaty of Paris (1763) marked the loss by France both of her great dominions in America and her ascendancy in India. This loss, together with internal inefficiency and abuses of administration, brought upon the

THE CHARGE OF THE CUIRASSIERS



This painting by A. Morot represents a scene typical of the Franco-Prussian War. It took place at Rezonville, near Metz, August 16, 1870. The French Imperial Guard was ordered to charge in the face of withering fire. To obey meant death, yet they rode forward at full gallop, crumpling the Prussian cavalry, only to be mowed down in turn by the German guns and rifle fire.

Charlemagne's empire after his death fell into three parts, the western part becoming the kingdom of France. But the word "kingdom" meant little, for the spread of the feudal system distributed the power of government among local rulers and left to the king little but nominal overlordship. Under the Capetian kings, of whom Hugh Capet was the first (987), this system—or rather lack of system—reached its height. (*See* Feudalism.)

Some progress was made under Philip Augustus (1180-1223), Louis IX (1226-70), and Philip IV (1285-1314). But France was still in a disorganized

government much criticism. An educated middle class was growing up who were dissatisfied with the "old régime" and demanded an influence in the government proportionate to their wealth and education. The crisis came when the financial difficulties of the state, which had been increased by the help afforded to the American colonies in their struggle for independence from England, forced the government to call the Estates-General in 1789. Then followed the Revolution, an heroic struggle against foes within and without, in order to establish a new political and social order. The failure to set up an able and just



This is a street in the city of Verdun as it looked after World War I. Battered by months of cannon fire, it was reduced to a ruin as desolate as those ancient cities which have lain

deserted for thousands of years in Oriental deserts. Later the industry of the French made these areas prosperous again only to have them battered once more during World War II.

government paved the way for Napoleon Bonaparte. He then turned to his own profit the enthusiasm kindled by the Revolution (see French Revolution).

French Revolution and Napoleon

As emperor of the French (1804-14) Napoleon attempted to make the French power supreme in Europe. The attempt failed, and in the peace of Vienna (1815) France was reduced to its former limits. Nevertheless the great principles of the Revolution—nationality, constitutional government, and equality before the law—had laid the foundations not only of a new France but of a new Europe. Perhaps the most permanent work of the Revolution was to give the French peasants the land which they have continued to own to the present day. This wide distribution of land in small holdings remains characteristic of France and makes for conservatism.

France was slow in accustoming itself to the new order. The Revolution of 1830 (July 27-29) overthrew the restored Bourbons—who had learned nothing and forgotten nothing—in the great Revolution—and brought in the Orleanist prince Louis Philippe as a constitutional monarch. He fell in the Revolution of 1848 (Feb. 22-24). After a stormy experiment with a second republic the Second Empire began under Louis Napoleon Bonaparte (nephew of Napoleon). He had a troubled but pretentious reign from 1852 to 1870 as Napoleon III.

The lightly begun but ruinous war with Germany brought the downfall of the Second Empire (See also Franco-Prussian War). For several years after the war

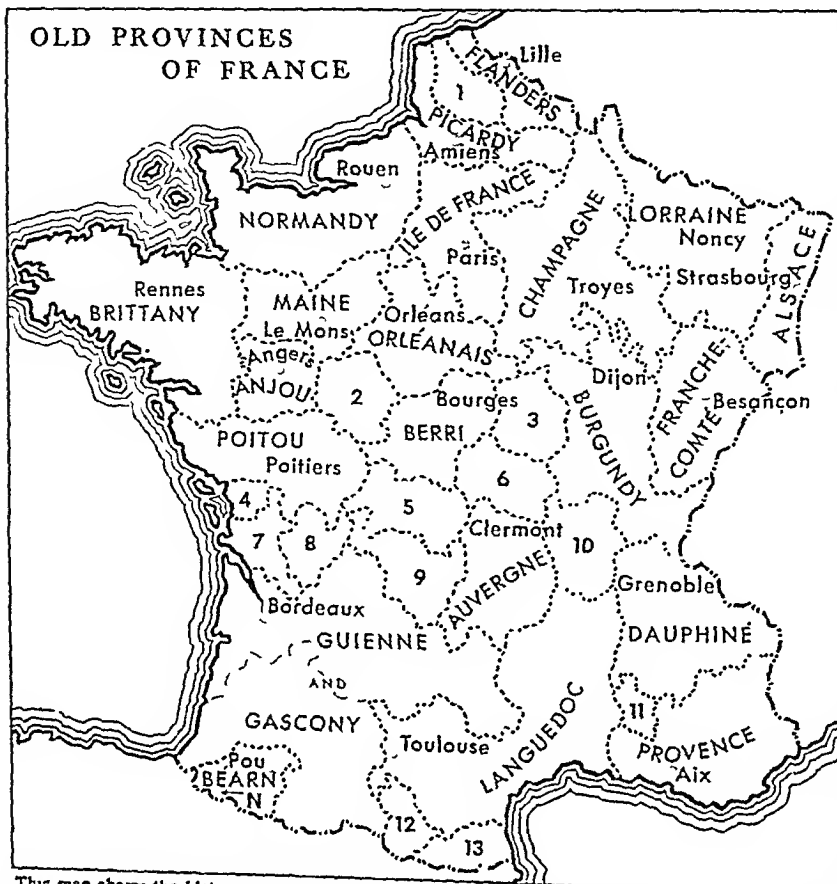
the government of France was in a state of turmoil, but with the establishment of the Third Republic in 1875 the political and economic affairs of the nation became more stable.

It maintained a democratic government in the stress of World War I, but its losses in man power and property were prodigious. More than one fifth of the total population was mobilized, and losses in killed and wounded ran well into the millions. More than 9,000 square miles of northern France were occupied by the armies. This section contained approximately one eighth of France's population and a great share of the nation's industries and mines. At the close of the war this region was one vast scene of desolation. Hundreds of towns, with their factories and homes, were deserted wastes. Millions of acres of once prosperous farm land had been scarred with shell holes and trenches (See also World War First).

France after World War I

The treaty of peace signed at Versailles, however, provided enormous benefits for France. Germany was brought to its knees. France took over a large part of Germany's colonies and regained Alsace-Lorraine, which had been taken by Germany in 1871. As recompense for the damage done to its northern provinces, France was given a 15-year lease on Germany's Saar coal mines, and Germany was obliged to make huge reparations on payments.

These provisions brought trouble. Alsace-Lorraine, under Germany, had had local self-government in



This map shows the historic provinces of France, which existed until the days of the French Revolution. Smaller provinces and their capitals (in parentheses) are numbered from top to bottom as follows: 1. Artois (Arras); 2. Touraine (Tours); 3. Nivernais (Nevers); 4. Aunis (La Rochelle); 5. Marche (Gnèret); 6. Bourbonnais (Moulins); 7. and 8. Saintonge and Angoumois (Angoulême); 9. Limousin (Limoges); 10. Lyonnais (Lyons); 11. Comtat Venaissin (Avignon); 12. Foix (Foix); 13. Roussillon (Perpignan). The letter N in the southern part of Béarn indicates the French portion of Navarre, the country which gave France the Bourbon family of kings.

cluding control of its own schools, in which Catholic religious instruction was given. In France, however, local government was entirely controlled from Paris and there was no religious training. But France finally permitted religious instruction to be given apart from ordinary classroom work. In 1923 Premier Poincaré was unable to collect reparation payments; so he seized the Ruhr Valley, Germany's most important mining and manufacturing district. This reduced Germany to bankruptcy, but forced it to sign an agreement for payments, called the Dawes Plan, in 1924.

Meantime France developed its other gains from the peace treaty. The Saar Basin and Lorraine gave it coal, iron, and potash with which to develop great steel and chemical industries. To secure its treaty gains France backed the League of Nations, which guaranteed the *status quo*, the Locarno Pact, by which Great Britain and Italy guaranteed its German frontier; and the Kellogg-Briand Pact, which outlawed war. Alliances were made with Belgium, Poland, Czechoslovakia, Yugoslavia, and Rumania.

France built an unbroken line of fortifications (the Maginot Line) along the German border, and added a secondary line on the Belgian frontier. It increased its army and navy, and made loans to its allies to permit them to build up their strength.

For a few years after the war, France's position was the strongest in Europe, but the cost of this policy of defense was greater than the nation could bear. After raising taxes to extremes, the government was forced, in 1926, to cut the gold value of the franc from 19.3 cents to about 4 cents. This cut off about four-fifths from the government's gold debt, and made French goods cheap for foreigners to buy. With a cheap franc it appeared that France might again be prosperous, and in 1929 a new reparation agreement, the Young Plan, fixed for the first time the total amount Germany was to pay.

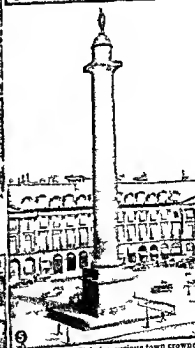
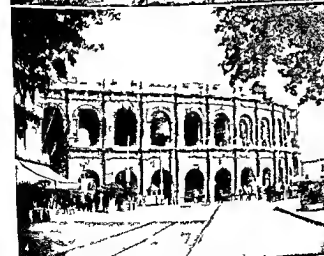
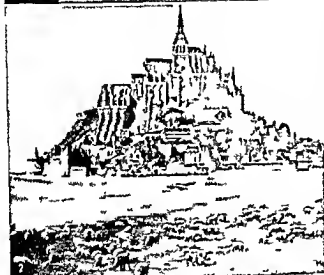
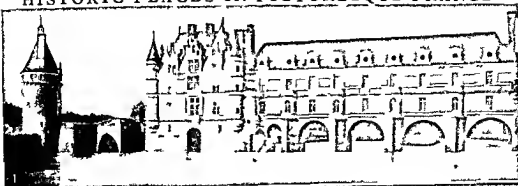
But with the world economic depression, Germany again refused to pay. Then the Hoover moratorium of 1931 postponed payment; and a new agreement, reached the following year, practically wiped out the debt. France thereupon stopped repaying its war debt to the United States. The franc was no longer cheap by comparison, because Great Britain and later the United States reduced the value of their currencies.

Germany Challenges a Disordered France

With Hitler's rise to power in 1933, French supremacy on the Continent was challenged (see Germany). Hitler rebuilt the German army, navy, and air force, and he paralleled France's Maginot Line with fortifications on Germany's side of the frontier.

France's own affairs were in turmoil. French politics, always volatile under the Third Republic, were more unstable than ever. Virtually no accord could be reached by the three major parties—Communists, Socialists, and the more moderate Radical Socialists. Many small parties, several of them rightist groups, added to the discord. Lacking a solid majority, each

HISTORIC PLACES IN PICTURESQUE FRANCE



1 The Chateau of Chenonceaux with its gallery built across the Cher River 2 Mont Saint Michel a curious town crowned by an ancient abbey fortress on a rocky islet off the northern coast of France 3 Carnac a village in Brittany renowned for its long avenues of prehistoric stone monuments 4 Ruins of the old Roman arena in Nîmes 5 The Place Vendôme in Paris looking toward the famous Ritz Hotel the tall column is crowned by a statue of Napoleon I.

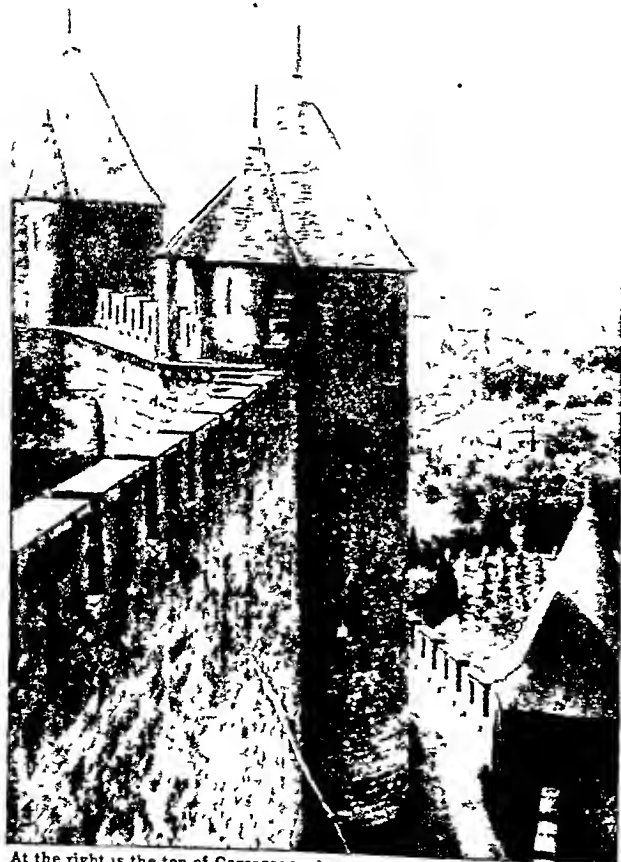
successive premier was forced to temporize. Distrust and unrest mounted until civil war was threatened between Communists and Rightists.

A Confused Foreign Policy

This dissension at home was reflected in France's foreign policy. After the terrific losses in the first World War, France wanted above all to remain at peace. Yet, when the rise of Hitler threatened a general war in Europe, the French people failed to consolidate their diverse personal interests into a strong consistent foreign policy. Communists feared Italy; Rightists feared Russia; others distrusted Britain. In the face of this confusion, the weak French government tried to encircle Germany. To this end France signed a mutual aid pact with Russia in 1935 and then tried to win Italy's friendship by supporting Italian claims on Ethiopia in 1936.

Foreign troubles and the continued economic depression led the three major French parties to unite in a Popular Front government in 1936. With this liberal group in control, French labor launched a wave of sit-down strikes to force industrial reforms.

MEDIEVAL TOWERS WATCH OVER CARCASSONNE



At the right is the top of Carcassonne's outer wall, with notches (crenellations) for bowmen. The inner "curtain" wall rises at the left. The walls were built in the 5th century, rebuilt in the 12th and 13th, and restored in the 19th century by the celebrated French engineer Viollet-le-Duc.

The Popular Front granted a 40-hour week, paid vacations, and collective bargaining. It also nationalized the Bank of France. But foreign policy remained vague. When civil war broke out in Spain in 1936, France refused to intervene (*see* Spain).

In 1938 France joined England in "appeasing" Hitler by acceding to his demands in Czechoslovakia (*see* Czechoslovakia). But when Italy's seizure of Albania in 1939 revealed that "appeasement" led to further aggression, France and England guaranteed aid to Poland, Greece, Rumania, and Turkey. When Germany invaded Poland in September 1939, France and England declared war.

Defeat in Second World War

But France invited defeat. Torn by internal strife and still weak from the first World War, it had little heart for combat. With its ally Britain it elected to wage a defensive war of attrition. This passive strategy failed when the Nazis outflanked the Maginot Line in May 1940 (*see* World War, Second).

Panic and defeatism gripped the government. It refused Britain's offer to form a joint empire, with mutual citizenship. Instead, the government retreated from Paris to Vichy. There on June 17, 1940, Marshal Henri Philippe Pétain as premier asked Germany for an armistice. On June 22 France signed the surrender terms. France had suffered little damage in the brief fighting but it had lost some 1,500,000 men as prisoners of war, and the sudden, crushing defeat had broken the national spirit.

At first only the northern half and the western coast of France were occupied by Germany. The remaining "Free Zone" was permitted to establish a puppet French government at Vichy under Premier Pétain. This cleavage of France into two zones was a Nazi device to split the French people.

Third Republic Gives Way to Dictatorship

At Vichy, Pétain declared the end of the Third Republic, July 11, 1940. He established a dictatorship with himself as chief of state and Pierre Laval as vice premier. To symbolize the change from democracy to totalitarianism, Pétain banned the national motto, "Liberty, Equality, Fraternity." He officially substituted "Family, Labor, Fatherland."

But abroad, the historic French spirit of liberty flamed a challenge. Part of the French northern army had escaped from Dunkirk to England. General Charles de Gaulle organized this force into "Free French," later called "Fighting French" (*see* Gaulle). In a defiant radio broadcast, de Gaulle declared, "France has lost a battle. She has not lost the war."

In France, Pierre Laval gained increasing power and led the Vichy government into virtual collaboration with Germany. He per-

mitted thousands of Frenchmen to be deported for work in Germany and diverted a large part of French industry to the Nazis.

France lost its remnant of independence soon after the Allies invaded North Africa on Nov. 8, 1942. To meet a possible threat of invasion from the Mediterranean, Germany broke the French surrender terms and occupied the rest of France on November 11.

French Spirit Awakens

Thus betrayal awakened the French. Their love of liberty revived. When the Germans threatened to take France's fleet at Toulon, French crews blew up the ships. Thousands of Frenchmen throughout the nation created an underground organization called *La Maquis*, ('the underbrush'). This later became the F F I, or French Forces of the Interior, which was supplied with arms purchased from Allied planes.

Nearby Adm. François Darlan deserted the Vichy government to join the Allies in North Africa. On Dec. 1, 1942, the turncoat Darlan became chief of state in North Africa. On December 24 he was assassinated in Algiers. This lifted General de Gaulle to power. De Gaulle, on June 13, 1943, formed the French Committee of National Liberation, which became the nucleus of the exile government of France.

Allied Invasion Makes France a Battleground

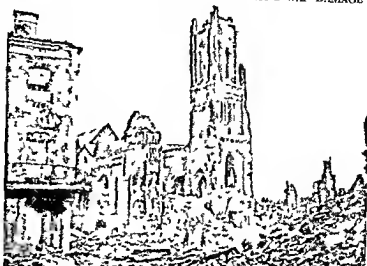
Four years after France had surrendered to Germany, the Allies invaded on June 6, 1944. The speed of the Allied sweep spared most of France from heavy damage. Only the coastal and northern regions suffered severely. F F I forces joined de Gaulle's army units and aided the Allied drive. In Paris the people attacked the Germans, virtually freeing the city before French troops entered in victory on Aug. 20, 1944.

The provisional government of de Gaulle quickly seized collaborationists (Frenchmen who had worked with the Germans). War crime trials started almost at once. Pierre Laval, leader of the men of Vichy, was tried and executed in 1945. Marshal Pétain was also found guilty of treason. Respect for Pétain's advanced age led de Gaulle to commute the marshal's death sentence to life imprisonment.

Reconstruction Brings Enormous Problems

The end of the war found France in low estate. It had fallen from a world power to a weak nation. It was hungry and poor. Industry, looted by Germany and battered by Allied bomb raids, had to be rebuilt. To meet world competition in mass production, French industrialists knew they must modernize their machines and methods. Yet French financial resources

NORMANDY TAKES BRUNT OF SECOND WORLD WAR DAMAGE



The shattered cathedral of Notre Dame starts badly down on the ruins of St. Lô as the Cherbourg peninsula. Fierce fighting raged here until the United States First Army wrested St. Lô from the Germans for the Normandy breakthrough. July 1944.

were so meager that devaluation of the franc was necessary. Manpower too was lacking. Thousands of war prisoners returned malnourished and ill. Moreover, a declining birth rate was estimated to have reduced the population of France by some 1,500,000.

The national unity that had animated France at the end of the war soon faded. The pressure of reconstructing the government split the French into several political factions. Communism increased, but met opposition in a new moderately liberal party, the Popular Republicans (*Mouvement Républicain Populaire* or MRP). Socialists formed another strong bloc.

As provisional president, de Gaulle kept aloof from the rival parties. Rigid uncompromising he nevertheless welded the factions into a Provisional Assembly. When France elected (by popular vote in September 1945) to establish a Fourth Republic, the Assembly began to write a new constitution. The new charter greatly limited the power of the president. In protest, de Gaulle resigned in January 1946.

Fourth Republic Experiments with Socialism

France began a new era on Oct. 13, 1946, when the people voted to accept the new constitution. The close vote, however, showed that France was still sharply divided. Months of bargaining and political strife passed before the new National Assembly could agree on a president. On Jan. 16, 1947, it elected Vincent Auriol, a Socialist, for the seven-year term. His cabinet formed a coalition régime.

In an effort to revive French economy, the government experimented with moderate socialism. It nationalized the Bank of France and several major industries including coal, gas, electricity, airplane lines and insurance. Flexible laws left some companies under private control in nearly every field.

NEW CONFLICTS ARISE AS FRANCE REBUILDS FROM OLD WAR



Indo-Chinese troops in the French army hunt Vietnamese rebels in tropical Indo-China. The costly warfare began in 1946.



Across the Mediterranean, Arab nationalists launch terror riots for Tunisia's independence. These men are under arrest.



French workmen are still repairing the damage done to Orléans in World War II. Here they work on a housing project.

France helped to occupy Germany, administering the area west of the Rhine. In 1947 the Italian peace treaty gave France small gains on the French border.

In an effort to speed the economic recovery of France the government created a General Planning Board in 1946. This agency drew up the Monnet Plan, which aimed to make France self-supporting by 1952. Industry received a stimulus when France took economic and political control of the Saar in 1947.

The French government continued in its usual political turmoil. The middle-of-the-road coalition regime met constant opposition from the strong French Communists. De Gaulle resumed activity in 1947 as head of a new opposition party, Rally of the French People, or RPF.

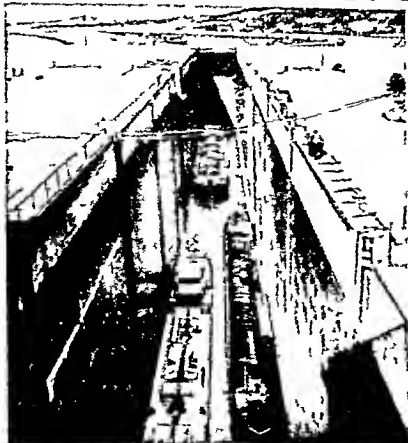
In 1948 France signed a trade pact with Britain and the Benelux countries. That same year the French

began to get enormous economic aid from the United States in the European Recovery Program.

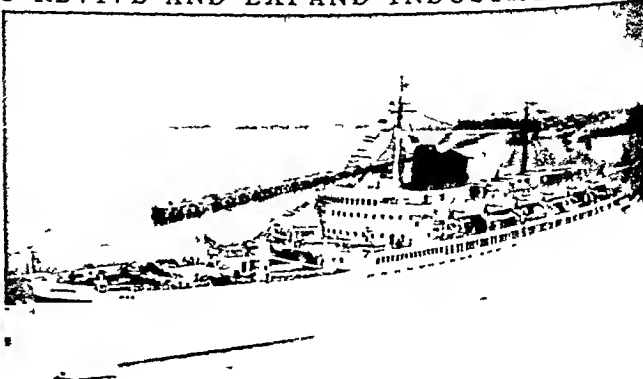
Seeking collective defense against Russia, France in 1949 signed the North Atlantic Treaty. In 1951 the North Atlantic Treaty Organization (NATO) set up its military command near Versailles. The NATO called on France to raise a large force for a European defense army. By 1952, however, armament costs at home and in Indo-China had critically weakened France's economy.

Meanwhile, in 1950, France offered the Schuman Plan, one of the most constructive ideas in the history of modern Europe. The plan proposed to pool the coal and steel industries of France and West Germany by removing customs duties and other trade barriers. France believed that this would lessen the threat of any future war between the two countries. Other

FRANCE STRIVES TO REVIVE AND EXPAND INDUSTRY



The Donzère-Mondragon Canal (left) is part of a huge hydroelectric power project in the Rhone Valley. France built it with Marshall Plan aid. Barges sail to the Rhine River.



Right, the new French liner *Flandre*, 20,500 tons, sails from Dunkirk on a voyage to New York. French shipbuilding is recovering. French passenger ships are noted for sleek lines.

nations of Western Europe also could join the plan. The French regarded the proposal as the first real step toward a federation of Western Europe.

Urged by the United States, six nations ratified the plan in 1957. They were France, West Germany, the Netherlands, Italy, Belgium, and Luxembourg. They set up a European Coal and Steel Community with headquarters in Luxembourg. The ECSC began to function in 1953 and was to be effective for 50 years.

Political Turmoil and Foreign Problems

Always restless politically, in 1953 France went from one political crisis to another. There were an many political parties that no single party could gain and hold control.

The prolonged war in Indo-China continued to be a costly and losing effort. Many French people wanted the government to seek a compromise. Several premiers failed to solve the problem. In June 1954 a new premier, Pierre Mendès-France, pledged to get an honorable settlement by July 20 or resign. Early on

July 21 he and Vietnamese representatives signed an armistice parit on Indo-China (see Indo-China).

Mendès-France sought to revise the European Defense Community plan to make it acceptable to the French, who feared an armed Germany (see Europe). On August 20, however, the French senate voted not to join EDC, thus killing that defensive pact. The Mendès-France cabinet was overthrown in February 1955 on the issue of granting concessions to Arab Nationalists in French North Africa.

Under his successor, Edgar Faure, the French Parliament on March 27, 1955, completed approval of the Paris agreements drawn up to replace EDC treaties. These pacts provided for creation of a Western European Union on authorization of a German army of 12 divisions within NATO, granting of sovereignty to West Germany and ending the three-power occupation of European part of the Saar Basin under the supervision of a WEU commission and admission of West Germany into NATO and the WEU.

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FRANCIS HOLY ROMAN EMPERORS Two emperors of the Holy Roman Empire bore the name Francis. Francis I (born 1708 ruled 1745-1765) the son of the Duke of Lorraine was the husband of Maria Theresa of Austria who influenced his election as emperor (see Maria Theresa).

Francis II (born 1768 ruled 1792-1806) was the grandson of Francis I and the last of the Holy Roman emperors. Napoleon's conquests diminished his possessions and in 1806 he renounced the title. As Francis I of Austria he reigned over Hapsburg lands until his death in 1835 (see Austria Hungary).

FRANCIS I KING OF FRANCE (born 1494 ruled 1515-1547) When Martin Luther launched his Reformation in the early part of the 16th century the destiny of Europe was in the hands of three young princes. Henry VIII was the impetuous tyrannical ruler of England. The Holy Roman Emperor Charles V was the cold calculating far seeking king of Spain (as Charles I) and emperor of Germany. The brilliant ambitious pleasure loving Francis I ruled France.

Francis I was the cousin of Louis XII whose daughter he had married. In 1515 the death of Louis without sons gave the crown to Francis as next in succession at the age of 21. Like Henry VIII of England Francis I embodied the spirit of the new age and in his reign the Renaissance or new birth of

learning and art which had begun in Italy flowered in France. He fostered learning and art invited painters and scholars to his kingdom founded libraries, opened schools of the New Learning and built several of the finest palaces in France.

However Francis injured France by a series of wars to wrest territory from Charles V. His first aim was to win the duchy of Milan in Italy. He hoped ultimately to win the entire Italian peninsula. The young king conquered Milan in a great victory at Marignano (present Melegnano) in 1515 and declared war on Charles V. Henry VIII joined Charles. They defeated Francis at Pavia in 1525 took him captive and forced him to renounce his claims to Milan.

Now England, Rome and the Italian states became alarmed at the power of Charles V and deserted him for Francis. Charles however emerged victorious in the war in Italy in 1529. Francis fought him again until 1533 with little gain but lost to him and Henry VIII in 1544 in the last of the series of conflicts. These wars filled the greater part of Francis' reign and left France exhausted.

One unintended result of the long struggle over Italy was that it so distracted the attention of Charles V that Protestantism was given a chance to take root in Germany. In France it also found a fleeting foothold only to be stamped out by Francis.

cis and his successors. The massacre in 1545 of the Waldenses, or Vaudois, a heretical sect who had survived from the Middle Ages in the French Alps, also left a black stain on the memory of Francis I.

FRANCIS II, KING OF FRANCE (born 1543, ruled 1559-60), the son of Catherine de' Medici and the grandson of Francis I, was the first husband of Mary, queen of Scots. He died before his 17th birthday, after a year of nominal rule.

FRANCIS JOSEPH I, EMPEROR OF AUSTRIA AND KING OF HUNGARY (born 1830, ruled 1848-1916). As a sequel to the insurrections which swept the Hapsburg dominions during the revolutionary year 1848, the weak-minded emperor Ferdinand abdicated in favor of his 18-year-old nephew Francis Joseph. General Windischgratz put down an uprising of the Czechs in Bohemia and afterward bombarded Vienna into submission. Lombardy and Venetia were reconquered by Radetzky. Finally Hungary, where the Magyars had proclaimed a republic under Kossuth, was crushed with the aid of a Russian army. The constitution which Francis Joseph had been forced to grant was withdrawn. He ruled despotically over his Magyar, Slavic, German, and Italian subjects.

Austrian prestige suffered seriously in 1859 with the loss of Lombardy in war with France and Piedmont and in 1866 with the loss of Venetia. A defeat by Prussia cost it the leadership of the German states. Hungarian unrest once more became dangerous, but prudent counsels prevailed against a policy of absolutism. In 1867 the emperor drew up a constitution by which the empire of Austria and the kingdom of Hungary became two equal and almost independent powers. They were united only by their common sovereign and by a common administration of military, financial, and foreign affairs (the "Dual Monarchy"). Francis Joseph retained a large measure of personal control, but he never again openly repudiated constitutional government.

To his mastery of the many languages and dialects of his polyglot realm, as well as to his tact, generosity, and attractive manners, he owed a large measure of popularity. Personal misfortune again and again assailed him. He lost his only son by suicide and his wife and nephew by assassination. His brother, the Emperor Maximilian of Mexico, was executed before a firing squad.

Meanwhile Austria had entered into close alliance with the German Empire, and together they pursued a fatally ambitious policy in the Balkans and the Near East. The assassination of the Austrian heir apparent, Francis Ferdinand, nephew of Francis Joseph, and his wife at Sarajevo, Bosnia, June 28, 1914, afforded an opportunity to strike the blow which, in Francis Joseph's opinion, would settle Balkan affairs once for all. The harshness in the terms submitted to Serbia, which in the end plunged the world into war, was dictated by Francis Joseph personally. He did not live to witness the resulting utter ruin of Austria and the breakup of the Hapsburg states. (See Austria-Hungary; World War, First.)

FRANCIS OF ASSISI (*a-se'ze*), SAINT (1182-1226). The father and mother stood in the doorway watching their young son playing gaily in the streets with his companions. Turning to his wife with an indulgent smile, the father said proudly, "Francis likes fine clothes and a gay life, and can spend money freely. Our boy is like the son of a prince, and will have a courtly career!" The merchant's wife nodded, but answered with a half sigh, "If he lives like the son of a prince now, hereafter he shall be a child of God!" The story is significant, if not historical. The mother little dreamed that this bright careless boy should one day become one of the most famous saints of the Roman Catholic church, the founder of the order of the Franciscans, or Gray Friars, and one of the most beloved characters in all history.

The future saint was born at Assisi, in central Italy, of a family named Bernardone. His father was a well-to-do merchant. In his early twenties, after a year's confinement as a prisoner of war and a serious illness, the old round of worldly pleasure no longer appealed to him. He sold his property, gave the money to the church, and began to tend the poor and the sick—even lepers. When his father disinherited him, Francis, wearing the worn-out robe of a gardener, supported himself by repairing tumble-down chapels around Assisi. At last, throwing aside even his stick, wallet, and shoes, he lived in absolute poverty.

Soon he began to attract followers. In ragged gray gowns, barefoot, and without money, the "begging brothers" went forth two by two to spread the gospel of service and poverty. As the brotherhood grew, members were sent to preach and serve in France, Germany, Hungary, Spain, and England. From Pope Innocent III they received numerous privileges. When a

SAINT FRANCIS OF ASSISI



Saint Francis abandoned wealth and a life of ease to embrace poverty. He aided the poor, weak, and sickly and founded the world-wide religious order of Franciscans.

girl of 18 named Clare left her home to follow his teachings Francis formed a separate order for women known as the Franciscan Nuns, or Poor Clares

For the rest of his life little brother Francis as he called himself continued his Christlike labors In various parts of the world he made long missionary journeys braving martyrdom in Mohammedan lands

Legends have adorned the simple facts of his life with many charming incidents It is said that he loved all living things, that wild rabbits ran to him for protection and that wolves crouched like lambs at his feet There is a famous account of his preaching to the little birds telling them how thankful they should be to God their creator He was a poet too and his lyric lines rugged and imperfect in form are very touching and beautiful—particularly in his famous Canticle of the Sun

At his death in 1226 it is said that on his body were found the famous stigmata—the marks of the nails and the spear of Our Lord's passion Two years later he was canonized (declared a saint) by the pope He is remembered as the most blameless and gentle of all saints the most Christlike figure of the Middle Ages Twenty years after St Francis' death his order had so grown that 9 000 religious houses had been built The Franciscan friars at one time numbered more than 100 000 Differences about the rules of St Francis resulted in divisions of the order In missionary work in caring for the poor in education and in other good works the Franciscan order is still active and influential

FRANCO FRANCISCO (born 1892) Short stocky Francisco Franco became dictator of Spain almost by accident He entered the Spanish civil war of 1936-39 with no political experience The death or failure of other rebel leaders thrust him to the fore



Francisco Franco became dictator of Spain

Born at Ferrol in Galicia the son of a naval officer he was sent at 14 to a military academy At 17 he was in Spanish Morocco fighting the Rifians He rose rapidly—a major at 23 commander of the foreign legion at 30 and a general at 34 the youngest general of the day in Europe

Thereafter Franco's fortunes rose and fell with the change of governments King Alfonso XIII at the end of the Rifian War made him director of a new military academy at Saragossa When Alfonso lost his throne in 1931 the republican government sent Franco off to the Balearic Isles A conservative government in 1933 brought him back as chief of staff to the minister of war Despite his small stature (5 feet 3 inches) and his soft speech Franco was a ruthless soldier In 1934 he suppressed riots of Asturian coal miners so harshly that Spanish workers called him

the butcher Then in 1936 a liberal government rose to power and exiled him to a small post in the Canary Islands

This proved a stroke of fortune for him Before his departure he had heaped to plan a military revolt When the plot exploded prematurely and its leaders at home were in confusion Franco free from interference was able to carry out his share of the uprising He flew to Morocco where he took command of his old African troops Then he transported them by air to the mainland and launched the military campaign which ultimately won him the title of El Caudillo—the supreme leader of fascist Spain (see Spain)

FRANCO PRUSSIAN WAR (1870-1871) The year 1870 found both France and Prussia eager to fight Since 1866 when Prussia had defeated Austria and won the leadership in Germany the leaders of the Second French Empire had longed to crush this upstart power Meanwhile Bismarck the chancellor of Prussia felt that a war was necessary to unify Germany War sentiment in both countries flared up when Bismarck published an altered version of the famous Ems despatch (see Bismarck Otto von)

Everything is ready declared the French minister of war to the last button on the last garter Yet when the French troops began to mobilize it was found that almost nothing was ready There were horses without harness cannon without ammunition machine guns without men who knew how to use them Prussia on the other hand had been so completely prepared by General von Moltke that all that was necessary was to touch the button to set in motion the greatest army organization then known The plan for the invasion of France had been formed long before and all that was needed was to take the necessary orders from the pigeonholes date them and send them out to the commanders France moreover stood alone without a single ally while the South German states and the North German Confederation rushed to the aid of Prussia

In an astonishingly short time after war was declared (July 19 1870) German troops invaded France in Alsace and Lorraine The French troops met them as best they could and though they fought bravely they were defeated in one battle after another between August 6 and September 2 One of their armies was bottled up in the strongly fortified city of Metz while the other on September 1 was fighting before Sedan This proved to be one of the decisive battles of the world—a battle that resulted in the surrender of the largest army ever to have been taken in the field up to that time a battle that dethroned a dynasty and changed the government of France On September 2 the French army of nearly 100 000 men with Emperor Napoleon III himself surrendered as prisoners of war

Such a terrible disaster to France astonished the whole world The early defeats of August had been announced by the government as victories but the deception could no longer be kept up When Napoleon a message—The army has been defeated and

is captive; I myself am a prisoner"—arrived in Paris, the mob began to cry "Down with the empire! Long live the republic!" Empress Eugenie fled; a republic was proclaimed, and a Government of National Defense organized (September 4).

Siege of Paris; Rats at 60 Cents Apiece

For five months longer this provisional government carried on the hopeless struggle. It was ready for peace but was resolved that "not an inch of our soil will we cede, not a stone of our fortresses." After Sedan the Germans hastened on to Paris and on Sept. 19, 1870, began the famous siege of that city. For four months the capital bravely held out. Early in the siege the fiery Leon Gambetta, head of the new government, escaped from the city in a balloon and worked desperately to raise new armies.

However, there was no possibility that they could break through the circle of iron around the doomed city. The sufferings of the Parisians during the siege were terrible. Dogs and cats were eaten. The price of rats rose to 60 cents apiece. Fuel gave out. Only when starvation was upon it did the city surrender (Jan. 28, 1871).

The war was at an end. A government recognized by Germany was formed, with the aged statesman Louis Thiers at its head, and made peace with Germany (Peace of Frankfurt, May 10, 1871). The victors demanded harsh terms. The greater part of Alsace and Lorraine was to be given them. An indemnity of one billion dollars was to be paid, and until it was paid a German army was to remain in France. France was also humiliated by the German troops marching in triumph through the streets of Paris and by the proclamation of the new German Empire (Jan. 18, 1871) in the French royal palace at Versailles. The hatred that these acts of the Germans aroused was not forgotten at the close of the first World War. Then the tables were turned and the French were victors and the Germans the vanquished.

Then Came the Commune

As though Paris had not endured enough, a desperate revolt broke out in the city against the new government. The Parisian workmen still had their arms, and they feared that the assembly would try to overthrow the new republic. So they rebelled and set up a government called the Commune.

This revolt broke out on March 18 and lasted until the end of May. Again the city was besieged but this time by the French troops of Thiers. When the government troops entered the city there followed a week of fierce civil war. Indeed, Paris suffered more from the Commune than from the Germans. When the revolt was put down no mercy was shown the rebels. Hundreds were shot without trial. More than 7,000 were sent as convicts to New Caledonia, in the South Pacific, and thousands more were sentenced to imprisonment at hard labor. In addition to the legacy of hatred left by the war between France and Germany was the bitter anger of the French working classes for the new "bourgeois" republic, which enfeebled it for 20 years or more (see France).

FRANKFORT, Ky. Pleasant old brick and stone buildings along quiet, tree-shaded streets are part of the charm of Frankfort, Kentucky's capital. It is located in the loops of an S-bend formed by the Kentucky River, about 50 miles east of Louisville. The narrow, deep river valley lies in Kentucky's rich bluegrass region.

Frankfort was founded in 1786 by Gen. James Wilkinson. It was named for the victim of an Indian attack surnamed Frank, who lived at a nearby river ford. Frankfort was soon changed to Frankfort. Soon after Kentucky became the 15th state in 1792, Frankfort was selected as the capital.

The surrounding country grew tobacco and hemp, and the trade and processing of these made the town prosperous. Corn whiskey was also an early product. Today, whiskey making is Frankfort's largest industry. In 1862 the Confederates seized the town. They were in the midst of installing a new state government when they were driven out by Federal troops. Between the end of the Civil War and 1900, sawmills were the town's most important industry.

The Old Capitol, on the north side of the river, was built between 1827 and 1830. It was constructed of crystalline limestone quarried from riverside bluffs. The texture of the stone is so fine that it is popularly known as "Kentucky marble." The Old Capitol holds the state historical society's museum and library. The New Capitol, built of New Bedford limestone, was completed in 1909. It is set in large grounds at the extreme south of the city. The grounds also contain the executive mansion. Notable in the New Capitol's art collection are statues of Abraham Lincoln, Jefferson Davis, and Henry Clay. Other places of interest are Liberty Hall, state-owned since 1937, once the home of Kentucky's first United States senator; Frankfort Cemetery, which has the graves of Daniel Boone and his wife Rebecca; and the Kentucky State College for Negroes. Frankfort has the mayor-council form of government. (See also Kentucky.) Population (1950 census), 11,916.

FRANKFORT-ON-THE-MAIN, GERMANY. The city of Frankfort (German *Frankfurt*) was founded some time during the 1st century on the banks of the Main River, about 24 miles from where that river joins the Rhine. Standing so close to a natural crossroads of trade, the city was from its earliest days a leading commercial center. After the Main was dredged, large traffic made Frankfort an important inland port. The city's key position also made it a center of Germany's railroad and airplane communications.

Few cities have played a more important part in Germany's history. Charlemagne had a palace here, and imperial councils met within the city's fortified walls. Here too Frederick Barbarossa was elected ruler of the Holy Roman Empire. This historic event set a precedent which became a law in 1356 when Charles IV issued the Golden Bull declaring Frankfort the place of election of the German emperors.

After 1816 the German Diet (parliament) met here. One of the free cities of Germany (see Democracy),

Frankfort did not finally lose its independence until it was annexed by Prussia in 1866. History was again made in the old city on May 10, 1871, when the Peace of Frankfort was signed here to end the Franco-Prussian War.

With the growth of printing in Europe, the city became a publishing center, and an elaborate monument honoring Gutenberg and other early printers was built here. Frankfort also developed into a great financial center. From the small moneylending shop of Meyer Amschel, which he called *Zum roten Schilde* (At the Red Shield), the House of Rothschild sprang in the late 18th century. It became the largest private bank in Europe (see Rothschild Family).

The commercial activity of Frankfort came to be surpassed in the late 19th century by the rise of manufacturing industries. Many factories were built to make heavy machinery, clothing, rubber, and elec-

trical equipment. As the new city began to displace the old, the medieval fortifications were converted into parklike forests, spacious gardens, and promenades. Many squares were laid out and flanked by public buildings. The house in which Goethe was born and spent his boyhood was restored and became one of Frankfort's most beloved shrines. Adjoining it was built the Goethe Museum, housing a valuable collection of the literary works of his period. The Städel Art Institute, containing one of the costliest and largest German collections of engravings, was established in the suburb of Sachsenhausen.

In the first World War, Frankfort suffered only slight damage by Allied attacks. But in the second World War, during the Allied drive into Germany, the city was heavily shelled and bombed by American forces before they succeeded in capturing it. Population (1950 census) 532,037.

BEN FRANKLIN— a GREAT American



The spirit of Ben Franklin, citizen of Philadelphia and of the world, looms over the city he helped make famous. This and the other two drawings are by Henry C. Pitt. They were drawn for the book *That Lovely Man, Ben Franklin*, by Jeanette Eaton. (Copyright 1945 by William Morrow and Company, Inc., and reproduced by permission of the publisher.)

FRANKLIN, BENJAMIN (1706-1790) One of the first great Americans was Benjamin Franklin of Philadelphia. Franklin devoted half his life to public service—first for the colony of Pennsylvania and then for the young United States. He made important inventions and one great scientific discovery. He was a writer who could be amusing yet powerful.

As scientist and statesman, Franklin was the first American to become famous in Europe.

Ben Franklin was at ease with everyone. Men in high places at home and abroad liked and respected him. Poor people loved him for he never forgot that he too had been poor and had made his own way. He started as a printer and always spoke of

himself as one. Franklin had a gay sense of humor and a charming way with young people. His mind was keen and his heart was warm. He was able to fit himself into any surroundings. America has always been proud of what he did for his country and for the world.

Boyhood in Boston

Benjamin Franklin was born in Boston on Jan. 17, 1706. His father, a soap- and candlemaker, had married twice, and Ben was the youngest son and the 15th of 17 children. Ben went to school only for a short time. Like other sons of poor men, he began working early. But he studied hard by himself and read every book he could borrow or afford to buy. Although he was put to work as an apprentice in the printing shop of his brother James before he was 13, he kept on with his studies in the evening.

Ben read the works of the great classic authors and of the writers of his own time. He especially enjoyed Addison and Steele's 'Spectator' papers, and these became his models when he was learning to be a writer. He would digest the thought of a 'Spectator' essay, then rewrite it in his own style. By comparing his work with the original, he saw his faults clearly. After much practise he achieved an easy and graceful style of writing.

It might have been great fun at the print shop. For Ben loved to learn and soon became a quick and accurate typesetter and proofreader. But an apprentice in the printing trade was paid very little. Moreover, he had to sign a contract and promise to stay on the job for nine years before he could become a master printer. This long term was made no easier by his brother's quick temper. James cuffed his apprentice for every mistake and whacked him with a ruler if he thought Ben was impertinent.

Yet nothing clouded the boy's lively mind. When James Franklin started his own weekly paper called

The Courant, Ben wrote a series of letters for it. In them he poked fun at Harvard college boys, at silly girls, and at poets who wrote poor verse. He sent the letters secretly and signed them with a woman's name, Mrs. Silence Dogood. The letters made a sensation in Boston, and people wondered who the clever author could be.

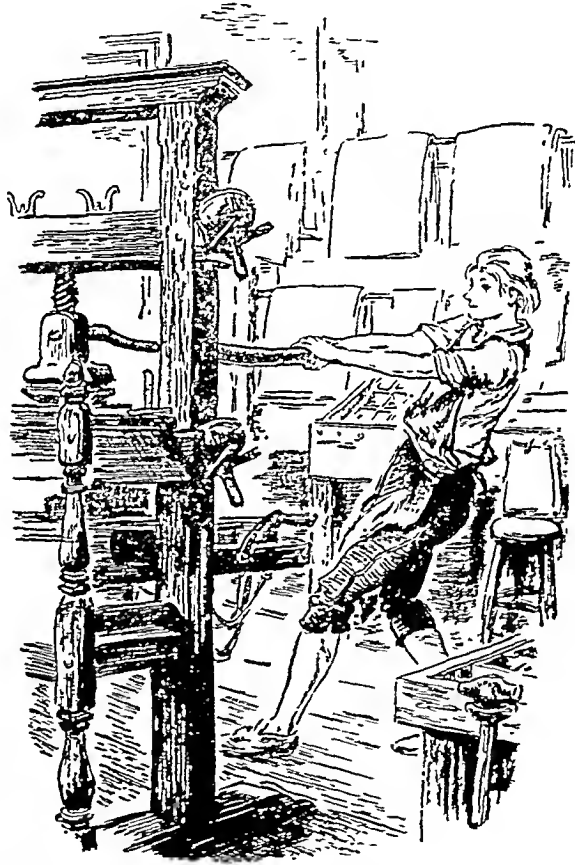
At last James found out that he had been tricked into printing pieces written by his 16-year-old brother, a mere apprentice. He was furious. His temper grew so much worse that finally the high spirited boy could bear it no longer. He left James Franklin's shop for good. Soon he found that no printer

in Boston would hire an apprentice who had broken his contract. Ben decided then to run away from home. One day in 1723 he took passage on a ship sailing for New York.

A Young Citizen of Philadelphia

At that time New York City was a muddy little town, and it had no work for a printer. So Benjamin went on to Philadelphia. After a long, hard trip he arrived one Sunday morning—a very rumpled, hungry boy with one silver dollar in his pocket. Many years later in his famous autobiography he described that first walk through Philadelphia's wide, peaceful streets. The famished boy bought three huge, puffy rolls and walked along munching one of them with the other two tucked under his arms. In a few days he found a job, and his skill as a typesetter was rewarded by good wages and the friendship of his employer.

Before long the governor of Pennsylvania took an interest in young Franklin. He told the youth he should open a shop of his own and persuaded him to go to London to buy a printing press and type. The governor promised to pay all expenses. But the promise was not kept and Ben found himself in London without a penny. Because he was a good printer, he soon found a job. He learned a great deal during the year and a half he stayed in the English city. But



As a printer's apprentice young Ben Franklin worked hard. One of his jobs was to operate this screw press. The lever action pressed a single sheet of paper down on a bed of inked type.

he was glad to return to Philadelphia and to his old employer. For him he set up the first press in America which could print on copperplate. This was used to print banknotes. Franklin was also the first American printer to mold type from lead forms.

In 1728, when Franklin was 22, he started his own printing shop with a partner who supplied the money. Soon afterward he won a contract to print all official notices and records for the Pennsylvania Assembly. Next he began publishing a weekly news journal called the *Pennsylvania Gazette*. As editor he wrote about the problems of the times and stood up for the rights of the people. Soon the *Gazette* was a great success.

When he was 24 years old, Franklin married Deborah Read, a lively, hearty girl who proved to be a good and saving housekeeper. In 1732 Benjamin published the first of his famous 'Almanacks'. It was a calendar and weather forecast for the year, but it also contained amusing little stories, jokes, wise sayings, and proverbs. Many are still popular today. One of his famous jingles was:

Early to bed, early to rise
Makes a man healthy, wealthy and wise.

Ben did not use his own name, but wrote under the name of "Poor Richard" (Richard Saunders). His cheerful common sense made the almanac so popular that soon he was selling 10,000 copies every year.

Public Servant and Inventor

Although Franklin worked hard, making money was only part of his activity. He scorned his own advice about going to bed early. He sat up every night to study English, French, and German scientific books and pamphlets. Moreover, he undertook many public welfare projects. He began by forming a club called the Junto. The members were young men interested in new ideas. They enjoyed arguing about life and science, but were also eager to give friendly aid to anyone who needed it. Backed by this group, Franklin started, in Philadelphia, the first circulating library in America.

He also formed Philadelphia's first volunteer fire company. He aroused such interest in preventing fires and putting them out quickly that before long 30 fire companies were in action. Later he helped organize the first hospital in America and an academy that later became the University of Pennsylvania.

Franklin's ability made him a marked man. He was appointed secretary of the Pennsylvania Assembly and later postmaster of Philadelphia. Before stamps

were used a person had to collect his own mail at the post office and pay for it by weight. Franklin stopped the money loss on unclaimed mail by printing in his newspaper the names of all persons who had mail awaiting them. He knew most people would rush to collect and pay for it. He developed a simple accurate way of keeping post office accounts.

Franklin had long hated the discomfort of houses half heated by drafty fireplaces. So he invented an iron stove. The back of this stood in the fireplace but its grate extended out into the room. This heater cast warmth in all directions. Everyone who entered his well heated room wanted such a stove. The governor of Pennsylvania urged Ben to patent his invention. But he refused. He wanted the stoves to be made cheaply so that many people could buy them. For more than a hundred years the Franklin stove brought comfort to thousands of families.

Franklin's Experiments with Electricity

Franklin and his club had long been interested in the

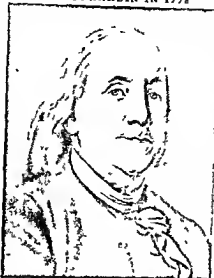
force of electricity about which little was then known. When a European scientist found a way to store electricity in a special jar or tube, Franklin ordered some of the tubes and set up a laboratory in his house. As he experimented he suddenly realized that lightning must be a discharge of electricity from the clouds. In 1752 he sent an account of this idea to the Royal Society of scientists in London, his paper was also sent to French scientists.

With the help of his son William, Franklin then proceeded to make the experiment suggested in his paper. He went to a meadow during a thunderstorm, flew a kite high in the air and brought a charge of electricity down the kite's wet string. Storing the charge in a jar half full of water, he hurried back to his study and hooked a wire from the jar to a wired bell. When the bell rang, he had sure proof that he had captured electricity from the sky.

This discovery brought him great fame all over Europe. He was made a fellow of the Royal Society in England. Yale, Harvard and the College of William and Mary in Virginia gave Franklin honorary degrees. He followed up his discovery by inventing the lightning rod to protect buildings from lightning bolts.

In 1753 Franklin was made deputy postmaster for all 13 colonies. At once he began to visit post offices and to improve the service. He put his bookkeeping system into every post office, hired more post boys, and made them feel that carrying mail was important. Instead of delivering letters from town to town only

BEN FRANKLIN IN 1778



This picture is from a portrait painted in Paris by the French painter, Joseph Suvée Duplessis.

twice during the winter, he had mail delivered every week. In four years he made the service pay and for the first time the British government made a profit.

The French and Indian War

The quarrels between Britain and France brought war to America (see French and Indian War). French hunters, trappers, and soldiers moving down from Canada had built forts along the Ohio River and had made friends with many Indian tribes. Northern colonies had long feared Indian raids. Even as early as 1748 Franklin had aroused Pennsylvanians to their danger. He started volunteer companies of soldiers drilling on the green and had guns placed along the Delaware River to keep off French vessels. In the summer of 1755 when British troops landed in Virginia, Franklin gave them important aid by hiring wagons to carry supplies. Then, at the request of the Pennsylvania Assembly, he went into the frontier to direct the building of forts.

In Europe

All taxpayers in Pennsylvania were helping to pay for the expensive defensive work except the owners of the largest tracts of land. These were the sons of William Penn, founder of the colony. They lived in London and cared little about the colony except to get money from the rent and sale of their land. To persuade the Penns to pay their share, Franklin was sent to London. There he had an enjoyable time, received honors from the University of Edinburgh and from Oxford, and helped put through a bill taxing the Penn family for its lands. He was in London when news came of England's victory over France in the French and Indian War.

Franklin returned home, only to find that a fresh quarrel had broken out between Pennsylvania and the Penns. Thoughtful members of the Assembly believed that it would be better if the king took over the colony. So they asked Franklin to go back to England and present their petition to King George.

In 1765, shortly after Franklin landed in England, Parliament passed the Stamp Act. Never before had

England laid a direct tax upon the colonists without giving them a chance to vote on it in their assemblies. A fury of protest broke out and Americans refused to buy the stamps. Franklin was called before the English House of Commons for questioning. He presented the case for Americans so clearly and reasonably that he was influential in persuading Parliament to repeal the Stamp Act. Franklin was now hailed as a great statesman.

For the next ten years, Franklin was the most important American representative in England. By personal talks and in pamphlets and newspaper articles, he tried to show that if the colonists were granted rights equal to those of Englishmen, peace could be made. He also teased Britishers about their ignorance of America by writing humorously exaggerated stories for newspapers. His reputation as a wit followed him wherever he traveled. In Germany and France he was welcomed not only as a scientist, but as a champion of liberty.

Many Englishmen in power, however, refused to listen to his good advice. They kept on acting like tyrants, and open rebellion broke out in America.

In 1775 Franklin returned to Philadelphia. He landed just after the battles of Lexington and Concord had

been fought in Massachusetts. At once he became the first postmaster general of the colonies and a member of the Second Continental Congress. He was appointed to a committee that drafted the Declaration of Independence and was one of its signers. Then Congress gave him an extremely important mission. He was asked to persuade France to help the United States in its fight for independence. Before he left, he lent Congress about 4,000 pounds of his own money. With his two grandsons Franklin set sail late in the fall of 1776 and reached Paris just before Christmas.

From the moment he entered the French capital, "The Doctor Franklin," as he was called there, was swamped with admiring visitors. Idealists, wise men, and scientists honored him. Ladies admired his fur hat



Parisians found Ben Franklin's wit and wisdom delightful. The old diplomat made many friends for the United States among Frenchmen.

and his twinkling sense of fun. His simple dignity appealed to everyone. Although two other Americans were in Paris representing Congress, the minister of the French king preferred to deal with Franklin.

Franklin worked very hard. First he had to secure formal recognition for his country. Then he had to persuade the French of the advantages of an alliance. His wisdom and affectionate understanding of the French people made him a successful diplomat. The Treaty of Alliance was signed Feb. 6, 1778 and Franklin was the outstanding figure in the celebration at the royal palace on March 20, 1778. For then King Louis XVI told all the world that France was the friend of the American Colonies and would help them in their fight for independence.

Five more years passed before the Revolution was won and the peace treaty signed. Franklin was one of the signers. He was ill a good deal and often wondered whether he would live to get home. When he finally started in 1783 he had tender farewell messages from his French friends, a gift from the king, and warm praise from French leaders.

Franklin's Last Years

In Philadelphia a tremendous welcome awaited the statesman. Old and frail as he was, he became president of the Pennsylvania Assembly and a member of the Constitutional Convention. Often members would disagree so strongly that the convention almost broke up. Then a word from Ben Franklin always calmed them. When the constitution was at last drafted, Franklin was one of the signers.

During those years Washington, John Adams, James Madison, and many other American leaders came to call at Franklin's house. They admired his books, the rockers he had made for his armchair, and the chair which would turn into a stepladder for reaching the top bookshelves. Although he was too ill to get about much, he enjoyed his friends and wrote newspaper articles and his famous autobiography. His last public act was to affix his signature to a memorial to the state legislature as president of the Pennsylvania society for the abolition of Negro slavery.

When he died at 84 on April 17, 1790 the world knew that one of liberty's true friends had passed away. Since then, Philadelphia has cherished his books and letters, models of his inventions, and many portraits of him. In Paris museums are many portraits and mementoes of the much loved ambassador. **FREDERICK, EMPERORS OF THE HOLY ROMAN EMPIRE.** During the Middle Ages three rulers of the Holy Roman Empire bore the name of Frederick. The Holy Roman Empire was a loose government which included the lands of Germany and Italy (see Holy Roman Empire).

FREDERICK I (BARBAROSSA) of the German house of Hohenstaufen ruled from 1152 to 1190. He was not only the greatest of the Fredericks but was also, in many respects, the ideal emperor of the Middle Ages. He had a lordly appearance though he was only of medium height. His hair was yellow, and his red beard led the Italians to nickname him "Barbarossa."

or Red-Beard. His ambition, as he wrote the pope soon after he became emperor, was to restore the position of the Roman Empire to the place it had occupied under the Caesars and under Charlemagne. To do this, he set about learning his rights as emperor and then attempting to enforce them.

Times however had changed since the days of Charlemagne. The pope was playing a larger part in European affairs and strong city republics had grown up in Italy. Several of them in northern Italy formed a coalition called the Lombard League to oppose Frederick. The league's army decisively defeated Frederick in the battle of Legnano in 1176. The Lombard cities then became almost completely independent as only a semblance of power was left to the emperor. Frederick was also unsuccessful in his contest with the pope. He was forced to humble himself before the head of the church in 1177, much as the Holy Roman Emperor Henry IV had done at Canossa just one hundred years earlier.

In Germany, however, Frederick was more successful than in Italy, and his reign marks one of the most brilliant epochs in the history of medieval Germany. He established his power over the turbulent German nobles. The land was cleared of forests, agriculture was improved, and the country advanced in wealth and in culture.

Toward the end of his reign Frederick Barbarossa "took the cross" and joined the Third Crusade. Before he reached the Holy Land he was drowned in a little stream in Asia Minor. Later generations, recalling the splendors of his reign, transferred to him a legend which had grown up about another German, Frederick. He was not dead, they said, but was sleeping in a rocky cavern of a German mountain when the ravens ceased to fly about the summit of the mountain. Barbarossa would awaken and return to restore to Germany the glories of former times.

FREDERICK II, the grandson of Frederick Barbarossa, inherited the kingdom of Sicily from his mother when he was three years old, but it was not until his troops defeated those of a rival emperor, 17 years later, that he could claim the title of "Emperor of the Holy Roman Empire" (1215-1250). He was known as "the wonder of the world" because of his varied attainments. He was a poet, a lawyer, and political reformer, and has sometimes been called the "first of modern men." His court in Sicily, where he spent most of his life—largely under Saracen influence—was the most splendid in Europe, and the laws of that kingdom the most advanced. But he neglected Germany in order to defend himself against the pope in Italy.

The nobles and the towns north of the Alps came to exercise rights which belonged to the emperor, and Germany grew more and more into a confused mosaic of city states and feudal principalities. Frederick's going on a crusade (1228-29) was a mere episode in his conflict with the pope. Frederick was able to maintain his power until his death in 1250, but soon after that date the triumphant papacy over-

threw with French aid the whole Hohenstaufen house, root and branch.

FREDERICK III, who ruled from 1440 to 1493, was the first important ruler of the Hapsburg house, and his reign is called "the longest and dulllest of all the reigns in German history."

He was slow, poor, and powerless. All he could do was to watch the course of events, consoling himself with gardening and astrology and muttering his favorite maxim, "What can't be helped had best be forgot." He accomplished one thing which left a lasting impression on history. A marriage treaty was made with Hungary by which that kingdom eventually became a Hapsburg possession. Frederick thus began that policy of "fortunate marriages" which built up the Hapsburg power.

FREDERICK THE GREAT, KING OF PRUSSIA (1712-1786).

One of the world's great military leaders, Frederick II of Prussia began his career by hating the life of a soldier. His father, rough, old Frederick William I, insisted on a practical, military education for his son. Young Frederick, however, resisted his father's instructions. He preferred music, art, and literature—especially French. He rebelled against tobacco, heavy eating and drinking, and hunting, which his father believed were the natural manly pleasures of royalty.

The king forbade the prince's tutors to teach him Latin but Frederick studied the classics in secret.

As Frederick became older, the relationship between father and son grew worse. Frederick's mother and his sister Wilhelmina sided with him against his father. This further enraged the stubborn king. Frederick William cared for nothing except the state of Prussia. He was horrified by the thought that this youth would one day be king and might wreck Prussia by his incompetence. He became more and more severe with his son, even beating him with a cane in front of army troops and boxing his ears in public.

When Frederick was 18 years old he tried to escape the tyranny of his father by running away. Caught before he crossed the border, he was locked in solitary confinement for a time. From a window of his cell he was forced to watch the execution of his closest friend, who had accompanied him in his flight. For a time the cruel king even thought of putting his son to death as a military deserter.

After this incident Frederick was changed. Although outwardly submissive, he became ruthless, crafty, and cynical. His father's iron discipline had triumphed beyond Frederick William's fondest hopes. Young Frederick now began his training to succeed his

father. Gradually the old king gave his son ever greater responsibilities.

Frederick Becomes King

When he came to the throne at the age of 28, Frederick had a keen mind, a strong character, and an ambition that soon engulfed Europe in war. He was to rule for 46 years, from 1740 to 1786. The first 23 years were devoted chiefly to warfare; the second, to peace and recovery. During the first half of his reign Frederick proved that as a soldier he had no equal. His last 23 years of rule showed that he was one of the enlightened despots of the 1700's.

As king, Frederick II worked hard. He acted as his own prime minister and treated his advisers as clerks. Only in his few leisure hours did he write poetry and history. Once he invited the French philosopher Voltaire to his Potsdam palace of Sans Souci. The two soon quarreled, however. (*See also Voltaire.*)

The Prussian Wars

Immediately after becoming king, Frederick acted on his own advice: "Take what you can; you are never wrong unless you are obliged to give it

back." He seized the rich Austrian province of Silesia, which plunged most of Europe into war (*see Seven Years' War*). It was in this series of struggles, lasting more than 20 years in all, that Frederick's military genius won him the title "the Great." Later he annexed West Prussia through the first partition of Poland.

During the first half of his rule Frederick truly made war the "national industry" of his country. His aggressive campaigns transformed Prussia from a minor state into a first-class power, nearly doubling its size by conquest and by diplomacy. Once he had satisfied his territorial ambitions Frederick undertook great public works and encouraged education, industry, and immigration. Strangely enough he spoke and wrote French almost exclusively, and had France as an ally in his first wars. The stern ruler died on the eve of the French Revolution, which shook forever the power of kings. Thus in a sense he was the last great absolute monarch in western Europe. (*See also Germany; Prussia.*)

FREDERICK THE GREAT



The "Iron King" of Prussia, as Frederick II was called, in his youth preferred to play the flute rather than to play the soldier.

FREDERICKSBURG BATTLE OF One of the bloodiest and most humiliating defeats suffered by the Union forces in the Civil War was that at Fredericksburg Va. on Dec. 13, 1862. General Robert L. Lee had retreated from the north as a result of his defeat at Antietam. With about 78,000 men he had established himself on the high bluffs of the Rappahannock River near Fredericksburg. The Army of the Potomac, numbering about 120,000 men under Gen. Ambrose E. Burnside, held the north bank of the river at Falmouth. Under great difficulties Burnside got his men across the river on pontoon bridges and attacked the strongly entrenched Confederates on December 13. After six assaults had been repulsed with great loss Burnside was dissuaded from renewing the attack. On the night of the 15th, under cover of a storm, what remained of the Union Army was brought back to Falmouth. Burnside lost 12,653 men while the Confederate loss was 5,309 men. Burnside was relieved of his command a week later by Gen. Joseph Hooker. (See also Civil War American.)

The gloom in which this disaster enveloped the North was changed to rejoicing a few weeks later by the news of the Union victory in the battle of Murfreesboro or Stones River, Tenn. (Dec. 31-Jan. 2). There the Confederate forces under Gen. Braxton Bragg were repulsed by Rosecrans' army. This repulse opened the way for the Union advance to Chattanooga and eventually to Atlanta and the sea.

FREEMASONS Properly called the Ancient Free and Accepted Masons, this secret fraternal society is also known as the Masons. It is a world-wide organization emphasizing the member's duty to his family, his country and his God and pledging his aid to fellow members. A set of passwords and a specific grip of the hand enable the initiated to recognize one another.

There have been many Masonic rites, chiefly English, American and Scottish. Modern freemasons have three symbolic degrees—Apprentice, Fellowcraft and Master Mason—which make up the blue lodge. A member may qualify for additional degrees, including the 33d of the Scottish Rite order. Other degrees include Royal Arch Mason, Mark Master Mason, Most Excellent Master, Royal and Select Master and Knight Templar.

Tradition ascribes several origins to masonry. One version is that it arose from guilds of masons or stoneworkers during the Middle Ages. These members made use of secret signs and passwords so that fellow craftsmen might recognize one another. Other stories carry the origin of the order back to the building of the temple at Jerusalem in the days of Solomon.

The earliest record of Masons in lodges occurs in Scotland with the blue lodge degrees dating from the early part of the 1700s. Masonry was introduced into America about 1730. In the United States today there are almost 4 million Masons, about two-thirds of the world membership. Fifteen United States presidents have been Masons.

An avowal of the Freemasons is the Ancient and Accepted Order of the Nobles of the Mystic Shrine. This

group is composed of Knights Templar or of 32d degree Scottish Rite Masons. It supports a score of Shriners Hospitals for Crippled Children.

The Order of the Eastern Star includes women relatives of Masons and Master Masons. It was founded in 1868. The Order of De Molay for Boys was established in 1919 for the teenage sons of Masons and their friends.

FREEZING Place a thermometer in a bowl of cracked ice and note the temperature as the ice melts. The thermometer will register 32°F (0°C). As a second experiment, place a pan of water where it can freeze and take its temperature as it turns to ice. The temperature is again 32°F. These experiments show that the melting and freezing points of water are the same. This is true of all crystalline substances such as ice, many metals and most minerals. Noncrystalline substances such as wax, butter, glass and iron do not have a definite melting and freezing point. As heat is applied to them in their solid state they gradually change to a doughy and finally to a liquid state. The melting and freezing temperatures given for such substances (as in the table on the following page) are approximations.

The experiments with the thermometer reveal another fact about such changes of state as melting and freezing. As ice takes heat from the air, its temperature rises until it reaches 32° when it stops going up. The ice remains at that temperature for a considerable time before beginning to melt. This lag is due to the nature of freezing and melting. The water molecules of ice are tightly bound in a crystal pattern. After ice reaches the melting temperature a great deal of heat is still needed to break these bonds and permit melting. There is a similar lag in the case of freezing. The same amount of heat has to be removed from the water after the freezing point is reached and before the water actually solidifies. The heat added to or removed from a substance to cause such a change of state is called *latent heat* or the *heat of fusion* (see Heat).

Under certain circumstances water can be cooled many degrees below its normal freezing point without turning to ice. Such a state is known as *supercooling*. Ice crystals normally form only around tiny specks of solid matter suspended in the liquid. In very pure water, which is free of such motes, crystals may not form at the regular temperature.

Although most substances contract as they cool and freeze, water does not. It expands nearly 10 percent. One cubic foot of water becomes 1.09 cubic feet of ice. This explains why a glass jar of water left outdoors on a frosty night is found shattered in the morning. It also explains why a lake freezes from the top down and not from the bottom up. The tiny ice crystals formed in the water are lighter than an equivalent volume of water. Thus they rise to the top and unite to make a solid surface of ice.

Another result of the tendency of water to expand as it freezes is that pressure will lower its melting point. One can prove this by suspending a heavy

weight from a wire loop passing around a block of ice. The wire will slowly cut through the ice but the block will remain perfectly solid. That is because the pressure of the wire gradually melts the ice, which freezes again as soon as the wire has gone through and the pressure has been removed. So too in skating the pressure of the skate blade on the ice melts a thin, slippery film of water. The same principle explains how glaciers—solid rivers of ice—can flow around bends in their valleys.

Water freezes at temperatures below 32° F. when a substance is dissolved in it. The most familiar example is provided by salt water. Sea water freezes at about 27° F. and a saturated solution of water and salt at -7° F. In large commercial refrigerating systems, brine is used as a secondary refrigerant for this reason (see Refrigeration). Antifreezes for automobile radiators are liquids that lower the freezing point of the water when dissolved in it. Methyl alcohol, though it has the disadvantage of evaporating rapidly from the solution, is most commonly used. "Permanent" antifreezes are largely ethylene glycol.

Salt absorbs water readily from solid ice, melting it and forming brine. As the brine is formed, it gives up heat to the ice and becomes very cold. That is why a mixture of salt and ice is used in an old-fashioned ice-cream freezer.

Freezing arrests the action of bacteria and so is used in food preservation.

Quick-freezing produces small ice crystals that do little damage to the structure of fruits and vegetables (see Food Preservation). FRÉMONT, JOHN CHARLES (1813-1890). The "path-marker" of the Far West was the brilliant, erratic Frémont. The first American explorers of the western wilderness had brought back only sketchy maps. Retracing their routes, Frémont made accurate surveys, and his work helped pioneers along the Oregon Trail.

His life was unusual. He was the illegitimate son of an emigrant French teacher and Mrs. Ann Pryor, wife of an aged wealthy landowner. Frémont was born in Savannah, Ga. After his father died in 1818, the family moved to Charleston, S. C. They had little money, but young Frémont won the aid of well-to-do people. He entered Charleston College in 1829. He was slender, unusually short (about five feet two inches), and handsome. But he was daring to the point of rashness and in 1831 he was expelled for "irregular attendance." He had shown skill in mathematics and a political leader secured him an appointment to teach mathematics on a war sloop.

JOHN C. FRÉMONT



As an explorer and soldier, he helped open the Far West.

Frémont's career as an explorer began when he left the navy to be a second lieutenant in the United States Topographical Corps (later the Army Corps of Engineers). In 1838-39 he was in Jean Nicolle's expedition to the plains between the upper Mississippi and Missouri rivers. In 1841 he headed his own expedition into the Iowa country. That same year he secretly married vivacious Jessie Benton, 17-year-old daughter of Sen. Thomas Hart Benton.

Frémont made three major expeditions to the Far West—1842, 1843-44, 1845-47. His wife was a writer and helped him make reports on soil fertility, Indian villages, trading posts, and adventures along the trail. On the expedition of 1845-47 Frémont helped to free California from Mexican rule. He served as civil governor for two months in 1847. But he opposed Gen. Stephen W. Kearny over military authority in the territory and this led to Frémont's court-martial. He was found

guilty. President Polk remitted the penalty, but Frémont resigned from the service.

Gold found on Frémont's Mariposa estate in the Sierra foothills made him a millionaire. He served as senator from California, 1850-51, and in 1856 was the first Republican candidate for president. He did not campaign actively, yet won a substantial vote. In the

Civil War he commanded the Western Department of the Union Army, but his rash political actions forced Lincoln to remove him. Later he held a brief command in Virginia.

After the war he lost his fortune in brash promotions of railroads. His wife Jessie supported the family by writing until Frémont was made territorial governor of Arizona. He served from 1878 to 1883. A few months before his death in 1890 he was restored to his army rank of major general and granted retirement pay. Jessie lived until 1902.

FRENCH, DANIEL CHESTER (1850-1931). At only 25 years of age Daniel French was famous. His statue of the 'Minute Man', commemorating the 100th anniversary of the battle of Concord, was unveiled before a notable audience including President U. S. Grant and Ralph Waldo Emerson. But young French was not in Concord, Mass. He was already in Italy, hard at work on a new statue.

The famous sculptor was born in Exeter, N. H., on April 20, 1850. His father, Judge Henry Flagg French, served under President Grant as assistant secretary of the treasury. Daniel's mother died when he was six. The boy's favorite hobby was bird study, and he enjoyed stuffing and mounting birds and animals.

The family moved to a farm outside Concord when Daniel was 17. Here he first showed artistic talent.

TABLE OF MELTING OR FREEZING POINTS	
Alcohol, Ethyl —167°F.	Olive Oil 36° to 43°F.
Carbon 6300°	Paraffin 131°
Copper 1982°	Silver 1761°
Gold 1945°	Sulfur 235° to 248°
Lead 621°	Tin 449°
Mercury —38°	Water 32°

With a jackknife he carved a bull
 frog out of a turnip. His father
 urged him to develop his talent
 for carving. A neighboring artist
 May Alcott, sister of the author
 of *Little Women*, gave him clay
 and tools and taught him the basic
 steps of sculpturing. The only
 other training he had was a few
 lessons in anatomy and a month in
 a sculptor's studio.

French's first major commission
 was the Minute Man. From then
 on his life was completely occu-
 pied by his work. He built a huge
 studio in Stockbridge, Mass.,
 equipped with tracks for hauling
 large pieces into the garden where
 he could study them in natural
 light. Winters he worked in New
 York City. He married his cousin
 Mary French in 1888. They had one
 daughter, Margaret, also a sculptor.

French was particularly success-
 ful at expressing typically Amer-
 ican subjects. His figure of the
 seated Lincoln in the Memorial at
 Washington is a good example. A
 host of his friend Emerson was
 French's favorite work. When the great essayist saw
 the finished bust he said, "Yes, that is the face I shave
 every morning." (See also Sculpture.)

Among French's best-known statues are "The Angel
 of Death Staying the Hand of the Young Sculptor,"
 Boston; the four groups "Asa," "Africa," "Europe,"
 and "America," New York City; and the "Standing
 Lincoln," Lincoln, Neb.

FRENCH AND INDIAN WAR In 1754 began the
 last contest in the struggle between France and Eng-
 land for the possession of North America. Three wars—
 King William's War (1689-97), Queen Anne's War
 (1701-13), and King George's War (1744-48)—had
 led to bring a final settlement. Each side saw
 it would have to fight harder to win the Ohio Valley.

The French made the first move. They began build-
 ing a chain of forts extending from the St. Lawrence to
 the Mississippi. The land they were occupying was
 claimed by the colony of Virginia under her sea-to-
 sea grant from the English crown. So the governor
 of the colony dispatched a small force under young
 George Washington to capture the French post Fort
 Duquesne on the present site of Pittsburgh, Pa. The
 expedition was unsuccessful and Washington had to
 surrender to superior forces.

The next year, 1755, was still more disastrous for
 the British. General Braddock, advancing on Fort
 Duquesne with a strong force of British regulars, was
 defeated and his army almost destroyed. He had not
 heeded the warnings of Washington, who knew how
 the French and Indians fought behind trees and rocks
 but had marched into the wilderness with drums beat-

COMMEMORATING A PIONEER IN EDUCATION



In 1888 Dan of French composed this group of D.
 Thomas H. Gallaudet teaching sign language to his
 first deaf-mute pupil. The statue stands in front of Gal-
 laudet College for the deaf in Washington, D.C.

ing and banners flying.
 Open to attack, he was
 surprised and defeated
 by the enemy. Brad-
 dock was mortally
 wounded and only
 Washington's skillful
 tactics saved the army
 from being wiped out.

By that time the
 struggle in America
 had become merely a
 part of a great conflict
 called the European War.
 Frederick the Great of Prussia
 fought England and
 Austria. Austria ally
 was France. For France
 and England it was a
 struggle for sea power
 and colonial rule. They
 fought in India, in
 Europe, and on the
 seas as well as in
 North America. Suc-
 cess came to the Brit-
 ish armies and it was

due largely to the able statesmanship and strategic
 planning of the prime minister, William Pitt.

In America during the two years following Brad-
 dock's defeat the English colonies were hard pressed.
 The British offensive had failed. The Indians all of
 the French plundered settlement after settlement
 along the border. The fall of Fort William Henry
 and Oswego on the New York front left that colony
 open to the ravages of the French. In 1758, how-
 ever, the tide turned. Pitt sent out a well-equipped army
 and fleet assisted by colonial troops. They captured
 Fort Louisbourg on Cape Breton Island, Fort
 Frontenac on Lake Ontario, and Fort Duquesne. The
 French line of forts was now broken. The next year
 Fort Niagara, Ticonderoga, Crown Point, and Quebec
 fell to the victorious British.

The most spectacular as well as the most important
 victory in North America was the capture of Quebec
 in 1759 (see Quebec, Montcalm, Wolfe). This prac-
 tically ended France's power in America, though the
 treaty of peace was not signed until 1763. In 1762
 France gave New Orleans and territory west of the
 Mississippi River to Spain as compensation for aid
 during the war. England gained a vast area east of the
 Mississippi, Canada from France, and Florida from
 Spain. (England restored Florida to Spain in 1783.)
 Thus the British Union flew over all the land east of
 the Mississippi and over Canada. In addition, on French
 rivalry with the British in India was ended. For the
 future United States, the English victory insured
 English speech and institutions, a Protestant majority
 in religion, and self-government.

The CLEAR and CHARMING LANGUAGE of the FRENCH

FRENCH LANGUAGE AND LITERATURE. The parent language of French, as of the other Romance languages, is Latin (*see* Romance Languages). Traces of this parentage are clearly to be seen in the great number of words that have come directly from Latin. Such words as *père* ("father") from the Latin *pater*, and *mère* ("mother") from the Latin *mater* clearly show this origin. Latin derivatives like these, indeed, constitute the bulk of the French vocabulary. French words, in the main, are simply Latin words which have been modified by natural development through the centuries.

Of the various dialects of Latin which sprang up over Europe during the early centuries of the Christian era, French was the first to be recognized as a separate language and the first to develop a literature. By the 9th century the dialect spoken in the north and center of what is now France, and that spoken in the south, had developed such marked differences that they were known by distinct names. The tongue (*langue*) of the south was called the *langue d'oc*, and that of the north the *langue d'oïl*, from the fact that the word for "yes" in the south was *oc* and in the north *oïl*.

Out of this northern tongue has developed the French language of today, a language which yields to none in clearness and richness. Of both the language and the literature which has sprung from it, the first and sharpest impression that the student receives is indicated in the famous remark, "That which is not clear is not French." More can be tucked away in a French sentence with less effort and less ambiguity than in any other modern tongue.

Fine Shades of Meaning in French

Not that in French it is necessary to express all thought bluntly and crudely. Black must be black and white, white, but there is much that is also gray; and for all fine variations of meaning, for delicate differences, French is the perfect tongue, because even in vague, cloudy matters, French must be clear. The very word *nuance*, by which the French indicate a subtle distinction, is appropriated by us in default of an English equivalent, just as our vocabulary has taken over many other French terms for the same reason.

But all this crystalline perfection, like every perfection, is bought at a price, and the price in this case is poetry, mystery, sentiment. For the French people, of whom the French language is the natural product and expression, are anything but mystical or sentimental. The advice of the philosopher Comte, "Feeling should always sway the mind," has no close grip upon the French—that logical, reasoning, real-

istic, methodizing race, formed so as always to see the point, often to their own inevitable boredom and dismay.

If only a little illusion, a little dull dreaminess, a little fear and doubtfulness could sometimes veil their penetrating and yet incomplete vision! Especially does this wish arise when one sees a bit of fluting Italian, or rich, pithy, bright English, translated into the uncompromising clearness of French. Yet to endow French more abundantly with "such stuff as dreams are made of" would be to rob it by just so much of its admirable lucidity.

The "Social Literature" of the French

This love for preciseness and clearness in literature is sharpened by the French social instinct. More than any other people, the French put the emphasis on society; less than any other do they interest themselves in the individual—his whims, his eccentricities, his special moods and traits. For this reason they have a "social literature,"

that is, a literature which concerns itself with matters of general social interest, rather than with the personal problems of the individual. Their writers remain within the illuminated circle of common experience, and seldom explore the uncommon, the mystic, the fantastic. Thus it happens that they are sometimes charged with being unoriginal and even superficial, especially by certain German critics.

With these charges in mind, Ferdinand Brunetière, one of the great modern French critics, has tartly replied: "The Frenchman piques himself on speaking clearly about matters which are sometimes profound, but the German seems to glorify himself too often on stating obscurely matters which are clear." The statement puts the French idea perfectly.

Brunetière is right in contending that in depth French literature compares favorably with any other. But it has a profundity of intelligence rather than of emotion, its fine distinctions are of thought rather than of feeling, its beauties are more often of form than of content, its triumphs are analytical and concrete rather than poetical or visionary.

Not a Language for Poetry

In view of such qualities as these in the French mind, it is therefore not surprising that French literature has gathered more laurels in prose than in poetry, whose very fabric is reverie, the intangible, the inscrutable. The French ardor for beauty of form has rendered their verse forms somewhat severe and rigid, though most graceful, elegant, and polished. Besides, no matter how clever the technique of the



MOLIÈRE
The Genius of French Comedy

poet the French language with its nasal sounds and tapping monotone is not an organ from which the sweetest music may be drawn. In any case —

Heard melodies are sweet, but those unheard
Are sweeter

and the unheard melodies of pure poetic fancy are somehow not a part of the French gift for delicate thinking rather than delicate feeling. Consequently if a reader is familiar with the subtle fairy singing of English poetry the supple sensuous beauty of Italian reminiscent of the arts of music and sculpture or even the long low rumble of German — that reader is often inclined to feel that French verses tinkle out in rhyme some

very soulless and conventional thoughts

But in tasting the delights of French prose there are no such secret protests to suppress. Here French clearness French elegance French insight truly come into their own. Where English prose sprawls in abundance the French is fine and shapely. Where the German and the Italian are often disposed to flounder in sentimentality the Frenchman is keen, firm, unimpaired. Where the Russian turns morbidly in upon himself the Frenchman is incorruptibly sound and sane, irrepressibly gay. In a world bitter with prejudice and flighty with wild dreams the Frenchman seems able to see with clear eyes to perceive with a cool heart. He is even exasperatingly right. If he does not sail among the stars he does indeed possess the

mountain winds of truth. Such have been the distinctions of French literature through a long history so long and rich and complicated that any brief account of it becomes merely a roll-call of world famous names.

Beginnings of French Literature

But before we come to the first of these names that of the chronicler Froissart there is a vast mass of folk-epics in verse of lyric poetry of mystery and miracle plays and of Roland Romance. As in

all other literatures verse preceded prose and it was not until the 14th century that we find any consider-

able body of prose composed on. This took the form of history or chronicles represented at their best by Froissart the famous contemporary of Petrarch in Italy and Chaucer in England who enriched and invigorated the French tongue much as Petrarch did Italian and Chaucer English. Soon after Froissart came Villon the vagabond poet whose hauntingly sweet and powerful lyrics stamp him as the greatest figure in French literature up to the time of the great men of the 16th century.

These creative geniuses — Rabelais the jovial humorist and satirist, Montaigne first and greatest of the modern essayists, Calvin the luminous theologian, Ronsard the elegant and original poet — these were the men who molded the French tongue into much the form it has today, expanding its resources and making it the

pliable, powerful vehicle of one of the world's greatest literatures. The French translation of the Bible made in the 16th century was a factor of weight in shaping the modern French language in the same way that the development of English, German and other European tongues was vitally influenced by the popular versions of the Scriptures.

During the closing years of the 16th and the opening years of the 17th century while Shakespeare was liberating English poetry from its dreary formalism and artificiality, Malherbe poet and critic was busy in France framing

a rigid form and cramping tradition for French poetry. In the 17th century came also the first of the salons or fashionable literary gatherings of Paris and the

establishment of the French Academy two powerful factors in the cultivation of taste and a sense of literary form (See Academy).

In the Days of the Grand Monarch.

One of the golden ages in French literature was the reign of Louis XIV (1638-1715) the monarch who declared *L'Etat c'est moi* (I am the state) and raised France to the position of the leading state in Europe. During his heyday flourished the three dramatic giants, Corneille, Racine and Molière, the preachers Bossuet and



VOLTAIRE
Master of Satire



ROUSSEAU
Who Stirred Revolt



FLAUBERT
Father of French Realism



DUMAS THE ELDER
King of Romancers



DE MAUPASSANT
Magician of the Short Story

Fénelon; the theologian Pascal; the poet Boileau; the inimitable letter-writer Madame de Sévigné; the wits La Rochefoucauld and La Bruyère; and many another of that great generation.

Then came the amazing, mocking Voltaire—sharply rational, gay, capricious, witty, chatty, vindictive, generous, "the spoiled child of genius," who attacked superstitions and social abuses on every hand and turned off scores of fat volumes, now widely unread. In his time he was "a founder of the future." His influence lay over all France until along came "the man from the Alps," Jean-Jacques Rousseau, a small fat Swiss, who, amid the skeptical Voltairean atmosphere, invented the first "back to nature" movement. A vagabond and lackey, he voiced the ideas which produced the French Revolution and overthrew the existing social order; half-starved in a garret, he launched modern ideas of hygiene and education.

The 18th century went out in the horror of the French Revolution. Diderot, editor of the first great French encyclopedia, and Buffon, philosophical naturalist, died before the Revolution. Bernardin de Saint-Pierre survived to produce his once highly popular 'Paul and Virginia'.

The Revolution destroyed a world of formalism and fixed ideas, and raised the curtain on the modern age. The old classical rules of writing were smashed, along with political laws. Writers made new forms, used words in new and vivid ways. This new rebellious trend was known as "romanticism."

The Brilliant "Romanticists"

The acute and cynical Stendhal (Henri Beyle), when reproached for his romanticism, declared he held a lottery ticket for the year 1935. His fame did not delay so long, however. The warmth of Italy that swept through 'La Chartreuse de Parme', and his skilful etching of complicated souls, had genius. Moreover, Stendhal's romances held many elements of realism, just as the poet, Alfred de Vigny, romantic though he was, exhaled the cool breath of classicism.

Balzac and Hugo, Mérimée and Dumas and George Sand, were the true leaders of the romantic movement. The vast stage of living beings of Balzac dwell in a world expressly made for them by Balzac. Hugo found no theme too dramatic, no tale too powerful, for his gifted pen. Mérimée led in the use of "local color," painting an exotic background, as in 'Carmen'. George Sand lost herself in a morass of sentimentality, and Dumas the elder poured forth a flood of lively tales too careless to be great.

The poet Alfred de Musset wrote fervid and impassioned lyrics, and the strange Charles Baud-

laire made great poetry of dark themes. Hugo said he gave the world "a new shiver." Théophile Gautier, who with his fellow romanticists danced derisively around the bust of Racine to celebrate the new times and supported Hugo at the production of his unconventional play 'Hernani', wrote poems, novels, and dramas of flawless excellence.

"Realists" Displace Romanticism

With Gustave Flaubert the new page of realism was turned in French literature. To pigeon-hole writers as "classicists," "romanticists," or "realists" is very artificial; yet it does put a name to some philosophical or emotional change. This growth or transition is recorded by sensitive writers. "Realism" was a reaction against "romanticism."

Flaubert presented life in its true colors—to him, drab. He worked upon his prose, word by word, like a sculptor of gems. His insight into character made

the novel of incident seem trivial. Even more self-consciously realistic, or naturalistic, were the Goncourt brothers, who "wrote with their nerves," took notes on revolting scenes in hospitals to get at the facts.

Dumas, the younger, a more careful workman than his famous father, wrote dramas rebuking a wayward world. He was far exceeded, however, by Emile Zola, leader of the "naturalists," who stirred up turgid social depths. The new "naturalist" school had as its theory that life should be presented without comment or opinion from the author. Just why it should be more natural to view life without opinions than to see it through the veil of one's own thoughts, moods, prejudices, and experiences, it would be difficult for a modern psychologist to say. And why the only "natural" scenes should be those from the slums, from vice and crime and sorrow, was a puzzle to readers even in the heyday of "naturalism."

Zola's own energetic temperament infused power into his tales of degradation, though his diffuseness, lack of proportion, and far from sculptural composition might well pain a reader of sensitive taste.

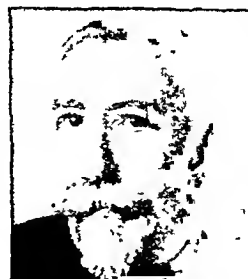
More typical of the French genius was Ernest Renan, gentle skeptic, brilliant historian and stylist, as were also Hippolyte Taine, Emile Faguet, and

Ferdinand Brunetière, all critics of distinction.

Anatole France, who recommended irony and pity as the best reply to modern life, has been likened to the great essayist, Montaigne, as having most delicately distilled a certain penetrating, smiling, disbelieving quality in the French spirit. Huysmans, however, was an uncompromising misanthrope, recording his hate of mankind in several volumes before his conversion to religion changed his viewpoint.



STENDHAL
Analyst of Romance



ANATOLE FRANCE
Critic of Life and Letters

All the world of amateur short-story writers has heard of Guy de Maupassant, genius of the short story, who perfected condensation, cold analysis and the bare, powerful style. Lover of the Orient and of the exotic, master of poetic prose, was Pierre Loti whose slight plots served as frames to long, delightful travel sketches.



MAUROIS
A New Style Biographer

Paul Bourget in his long list of widely read novels, opposed naturalism but borrowed its method, weighting his tale however, with a heavy moral or sociological thesis. The scientific point of view never yet created art, and the work of Bourget, in spite of keen psychology, lacks authentic warmth.

Determined to prevent the spirit of France, Mauriac turned abruptly from the pure egoism of his earlier works, such as 'Le Culte du moi', to an almost fanatical belief that "every living being is born of a race, a soil, an atmosphere, and genius manifests itself only in proportion as it is linked with its land and its dead." Mauriac was profoundly affected by German philosophy, and so likewise was Henri Bergson, a philosopher, noted for his forceful charming prose. Bergson held that the true nature of things is revealed to us more by intuition than by reasoning. This idea, essentially un-French, has influenced 20th century French writers so widely as to give Bergson literary importance.

American Favorites

An unusual understanding and appreciation of German character appeared in the ten volume trilogy 'Jean Christophe', by Romain Rolland, whose freedom from national prejudices naturally won him much harsh criticism. Rolland's masterpiece was as well known outside France as were the plays of his contemporary, Edmond Rostand whose 'Cyrano de Bergerac' and 'Chantecler' delighted audiences in many lands. The most rapid leap into the American best-seller list, however, was made by Abbé Ernest Dummett's 'The Art of Thinking'.

Symbolism, which makes its appearance from time to time down the centuries in all literatures, was rediscovered in France and elsewhere toward the end of the 19th century, particularly by the poets. Leader of the symbolists was Henri de Régnier, until he made an abrupt turn back to Greek traditions. Rich in learning, this poet steeped his verse in beautiful imagery, and also turned out prose comparable to that of Anatole France. Quite the opposite of the Régnier was Francis Jammes, sometimes called the Whittier of France. Simplicity, love of nature and of

animals, gentle thoughts of periwinkle skies, brought his verses great popularity. His Catholicism was less austere, his poetic fire less brilliant, than that of Paul Claudel, dramatist and poet.

Thoroughly pagan and thoroughly modern was the poetry of the Comtesse de Noailles. A sophisticated mixture of discontented modern and of ancient Greek, she wrote of the rapture of love, the terror of death, of her search for beauty. A similarly pagan, love-lorn trend pervaded the novels of Pierre Louys.

Of all modern writers, Marcel Proust most deeply influenced world literature. His literary genius surmounted even the exaggerated praises of his publisher and the Proust cult.

This sensitive neurotic who lived for years in a cork-lined room knew the world more profoundly than the most bustling 'man in the street.' His thoughts trailed out in a filigree of elaborate sentences. He spread his consciousness out like a must over the most banal scene, over the most shifting shade of the human soul. He was first and most convincing of writers to recognize that a man is not the same from moment to moment. His series 'A la recherche du temps perdu' constitutes a whole world, a whole literature.

Typical French Intellectuality

As distinguished as Proust, though less famous, was Paul Valéry, who succeeded to the place of Anatole France in the Académie Française. Because of his horror of facility, Valéry's slowly and carefully written volumes make but a thin package. In his work one feels that intelligence like a keen steel blade, typical of French writing. His deep study of the human spirit, not as a social unit but as a lonely thing, is as fine, in a totally different way, as the slow brooding of Proust. Valéry was induced to publish his works by André Gide, himself a deft writer, whose 'L'Immoraliste' was a shrewd study of the Puritan conscience.

Best known of French war books in America was 'Le Feu' (Under Fire) by Henri Barbusse, who did not surpass his war success. Jean Giraudoux, with 'Lectures pour une ombre', and Henri de Montherlant, with 'Le Songe', also wrote good books on the first World War. Montherlant typified the younger men who revived the ideal of discipline and self mastery.

Georges Duhamel opposed war in a number of effective short stories. The taint of decay left in Europe by the war was implied in the books of Paul Morand, who had a considerable success in America.



VALÉRY
Student of the Human Spirit



PROUST
Autobiographer of a Lifetime

with 'Ouvert la nuit' (Open All Night), as did André Maurois with his very popular 'Ariel: the Life of Shelley'. Jean Richard Bloch's 'Et Cie.' displayed a talent reminiscent of Balzac. He also wrote one of the best recent French plays, 'Le dernier Empereur'. François Mauriac, tortured by a sense of the evil nature of love, wrote bleak, powerful tales untrue to most experience. Jean Cocteau, jaunty boulevardier of talent, had a certain quick success with poetry, novels, a ballet, and pen-and-ink sketching.

GREAT FIGURES IN FRENCH LITERATURE

Chrétien de Troyes (12th cent.)—Arthurian romances.
Jean de Meung (or Meun) (14th cent.)—'Romance of the Rose'.
Jean Froissart (1337-1410)—'Chronicles'.
François Villon (1431-?)—'Petit testament'; 'Grand testament'.
Clément Marot (1495-1544)—'L'Adolescence'; 'Clémentine'; 'Blasons'; and other poems.
François Rabelais (1493?-1553)—'Gargantua'; 'Pantagruel'.
Pierre de Ronsard (1524-1585)—'Odes'.
Michel Montaigne (1533-1592)—'Essays'.
François de Malherbe (1555-1628)—Poems; translations.
Pierre Corneille (1606-1684)—'Médée'; 'Le Cid'; 'Polyeucte'; 'Oedipe'.
François de la Rochefoucauld (1613-1680)—'Maximes'.
Jean de la Fontaine (1621-1695)—'Fables'.
Molière (Jean-Baptiste Poquelin) (1622-1673)—'Tartuffe'; 'Le Bourgeois gentilhomme'; 'Le Malade imaginaire'.
Blaise Pascal (1623-1662)—'Pensées'.
Madame de Sévigné (1626-1696)—Letters.
Nicolas Boileau (1636-1711)—'Épîtres'; 'L'Art poétique'.
Jean Racine (1639-1699)—'Thébaïde'; 'Andromaque'; 'Bérénice'; 'Iphigénie'; 'Phèdre'; 'Athalie'.
Jean de la Bruyère (1645-1696)—'Caractères'; 'Mémoires'.
François de Salignac de la Mothe Fénelon (1651-1715)—'Télémaque'.
Voltaire (François Marie Arout) (1694-1778)—'La Henriade'; 'Zaïre'; 'Candide'; 'Dictionnaire philosophique'.
Georges-Louis le Clerc, Comte de Buffon (1707-1788)—'Histoire naturelle'.
Jean-Jacques Rousseau (1712-1778)—'La nouvelle Héloïse'; 'Contrat social'; 'Émile'; 'Confessions'.
Denis Diderot (1713-1784)—'Encyclopédie'.
Bernardin de Saint-Pierre (1737-1814)—'Paul et Virginie'.
Madame de Staël (1766-1817)—'Delphine'; 'Corinne'.
Stendhal (Henri-Marie Beyle) (1783-1842)—'Le Rouge et le noir'; 'La Chartreuse de Parme'.
Alfred de Vigny (1797-1863)—'Cinq-Mars'; 'Chatterton'.
Honoré de Balzac (1799-1850)—'Les Chouans'; 'Eugénie Grandet'; 'Le Père Goriot'; 'La Cousine Bette'.
Victor Hugo (1802-1885)—'Notre Dame de Paris'; 'Les Misérables'; 'Les Travailleurs de la mer'; 'Hernani'.
Prosper Mérimée (1803-1870)—'Colomba'; 'Carmen'.
Alexandre Dumas, the elder (1803-1870)—'Les trois Mousquetaires' (The Three Musketeers); 'Vingt Ans après'; 'Monte Cristo'.
Charles-Augustin Sainte-Beuve (1804-1869)—'Causeries du lundi'.
George Sand (Baroness Dudevant, née Aurore Dupin) (1804-1876)—'Jacques'; 'Consuelo'; 'La Mare au diable'.
Alfred de Musset (1810-1857)—'La Confession d'un enfant du siècle'; 'La Nuit de mai'.
Théophile Gautier (1811-1872)—'Émaux et camées', poems; 'Mademoiselle de Maupin', novel; 'Le Capitaine Fracasse', novel; 'La Mort amoureuse', short story.
Charles Baudelaire (1821-1867)—'Fleurs du mal', poems; 'Histoires extraordinaires' and other Poe translations.
Gustave Flaubert (1821-1880)—'Bouvard et Pécuchet'; 'Madame Bovary'; 'Salammbô'.
Edmond and Jules de Goncourt (1822-1896, 1830-1870)—'Germinie Lacerteux'; 'Madame Gervaisais'.
Ernest Renan (1823-1892)—'Étude sur les origines du christianisme', which includes 'La Vie de Jésus'.

A great French writer of modern times was Antoine de St. Exupéry, famed for his poetic prose style.

In poetry, novels, essays, and criticism, French literature of the 20th century has compared well with the record of the past; in drama, much less well (see Drama). Creative minds absorbed the idea that the world reveals itself in different ways to different temperaments, and thus brings about new ways, schools, or styles, of writing. (For Reference-Outline and Bibliography, see Language and Literature.)

Alexandre Dumas, the younger (1824-1895)—'La Dame aux camélias'.
Hippolyte Taine (1828-1893)—'Histoire de la littérature anglaise'; 'Origines de la France contemporaine'.
Émile Zola (1840-1902)—'Rougon-Macquart' series, including 'L'Assommoir'; 'La Bête humaine'; 'Le Débâcle'.
François Coppée (1842-1905)—'Le Reliquaire', poem; 'Le Passant', play; 'Contes', short stories.
Paul Verlaine (1844-1896)—'Fêtes galantes'; 'La bonne Chanson'; 'Sagesse'; 'Romances sans paroles'.
Anatole France (Jacques Anatole Thihault) (1844-1924)—'L'Île des pingouins'; 'L'Étui du nacre'; 'Thaïs'; 'L'Histoire contemporaine' series, including 'L'Orme du mail'; 'Le Mannequin d'osier'; 'L'Anneau d'améthyste'; 'M. Bergeret à Paris'.
Émile Faguet (1847-1916)—'Notes sur le théâtre contemporain'.
Joris Karl Huysmans (1848-1907)—'En Ménage'; 'La-bas'; 'La Cathédrale'.
Ferdinand Brunetière (1849-1906)—'Histoire de la littérature française classique'.
Georges de Porto-Riche (1849-1930)—'La Chance de Françoise'; 'L'Infidèle'; 'Amoureuse'; 'Le Passé'.
Guy de Maupassant (1850-1893)—'La Ficelle' (The Piece of String); 'La Parure' (The Necklace); 'Une Vie' (A Life).
Pierre Loti (Louis Marie Julien Viaud) (1850-1923)—'Le Pêcheur d'Islande'; 'Madame Chrysanthème'.
Paul Bourget (1852-1935)—'Le Disciple'; 'L'Émigré'; 'Un Divorce'; 'La Duchesse bleue'; 'Cruelle Énigme'.
Arthur Rimbaud (1854-91)—'Les Illuminations'.
Henri Bergson (1859-1941)—'L'Évolution créatrice'; 'Matière et mémoire'.
Maurice Barrès (1862-1923)—'Le Culte du moi'; 'Les Déracinés'; 'Les Bastions de l'est'; 'Colette Baudouche'; 'Le Jardin sur l'Oronte'; 'La Colline inspirée'.
Henri de Régnier (1864-1936)—'Tel qu'en songe'; 'La Sandale ailée'; 'Le Miroir des heures', poems; 'La Double Maitresse', novel; 'La Peur de l'amour', story.
Romain Rolland (1866-1944)—'Jean-Christophe'; 'Colas Breugnot'; 'Gandhi'; 'Les Cavcs du Vatican'.
Charles Maurras (1868-)—'L'Étang de Berre'.
Francis Jammes (1868-1938)—'Quatorze Prières'; 'Le Roman du lièvre'; 'Pomme d'anis'.
Edmond Rostand (1869-1918)—'Cyrano de Bergerac'; 'L'Aiglon'; 'Chantecler'.
André Gide (1869-)—'Nourritures terrestres'; 'Si le Grain ne meurt pas'; 'L'Immoraliste'.
Abbé Ernest Dimnet (1869-)—'Les Soeurs Brontë'; 'The Art of Thinking'.
Pierre Louÿs (1870-1925)—'Les Chansons de Bilitis'; 'Aphrodite'; 'Les Aventures du Roi Pausole'.
Marcel Proust (1871-1922)—'À la Recherche du temps perdu' series, including 'Du Côté de chez Swann'; 'À l'Ombre des jeunes filles en fleurs'; 'Le Côté de Guer-mantes'; 'Sodomie et Gomorrie'; 'La Prisonnière'.
Paul Valéry (1872-1945)—'La jeune Parque'; 'Odes'; 'Fragments du Narcisse', poems; 'Variété', essays.
Henri Barbusse (1874-1935)—'Le Feu' (Under Fire).
Anna-Elisabeth de Noailles (1876-1933)—'La nouvelle Espérance'; 'L'Honneur de souffrir'; 'Le Cœur innombrable'; 'Les Innocentes, ou la sagesse des femmes'.
Roger Martin du Gard (1881-)—'The Thibaults'.

Jean Gaudoux (1882-1944)—*Juliette au pays des hommes* Bella Lecture pour une ombre Siegfried play
Jean Richard Bloch (1884-1947)—*Et Dieu (à Co) La nuit* kurde Le dernier Empereur
Georges Duhamel (1884)—*Lettres au Pétagon* Les Hommes abandonnés Deux Hommes
Jules Romains (1885)—*Men of Good Will* (14 vols)
François Mauriac (1885)—*L'Enfant chagrin* de chloé Le Baiser au linceul Gentrax
André Malraux (1885)—*Amel* The Life of Shelley The Atmosphere of Love
Jean Cocteau (1891)—*Plein Chant* poem Enfants terribles Le grand Écart Thomas l'imposteur novels.

Jean Giono (1895)—*Coq (Hill of Desires)* Un de Baumugnes (Lovers Are Never Lost)
Henri de Montherlant (1896)—*Les Bestiaires* Les oncles devant la porte dorée Le Songe
Louis Aragon (1897)—*Les cloches de Bâle* The Bell of Basel Les beaux quartiers (Resden's Quintessence)
Antoine de Saint-Exupéry (1898-1944)—*Voie de nuit* (Night Flight) La Terre des hommes (Wind Song and stars)
André Malraux (1895)—*La condition humaine*
Jean Paul Sartre (1903)—*Age of Reason* Being and Nothingness
Albert Camus (1913)—*The Stranger* The Plague
novels Caligula play

The FIGHT for "LIBERTY, EQUALITY, FRATERNITY"



Here we see the Paris mob storming the Bastille, the old prison which represented royal oppression at its worst. This dramatic event which took place at about five o'clock in the afternoon of July 14, 1789, at once made it apparent to all that the old order had fallen. The prisoners were set free, many of the defenders were massacred and a few days later the fortress was demolished. The Bastille was originally one of the fortified gates of the medieval city of Paris. The great fortress was built about 1369.

FRENCH REVOLUTION When the French people overthrew their ancient government in the last decade of the 18th century they adopted as their watchword the famous phrase *Liberté, Égalité, Fraternité*—Liberty Equality Fraternity. Of the three Equality—the abolition of privilege—was to the French revolutionist the most important. For he was ready to sacrifice political Liberty as he did when he accepted the yoke of Napoleon. For it Fraternity or brotherhood with all men was allowed to remain a beautiful unfulfilled dream. But Equality before the law was achieved then and has ever since been maintained.

The Frenchman had a reason for his passionate devotion to equality. Before 1789 inequality was the characteristic of the old regime. Inequality met one

at every turn and hampered all progress. The nobles and clergy the privileged orders were exempt from such direct taxes as the *taille* and the chief burden fell on the Third Estate—such as peasants, artisans, merchants and professional men. Even among these taxes were not equal. Some provinces were exempt from certain taxes as the *gabelle* or salt tax. Then too the collection of certain taxes was done by contractors or tax farmers and the taxgatherer collected whatever he could. And woe to the man who seemed prosperous! As a result the peasant lived in a hovel and concealed his resources.

There were social and economic inequalities as well as political ones. The peasant groaned under the remnants of outgrown feudal dues which were being collected with renewed vigor by the nobles in the

THE ROYAL PRISONERS IN THE TEMPLE



When Louis XVI was arrested by the Revolutionists he was lodged in the prison known as the Temple. Here we see him asleep on a couch. The Queen, Marie Antoinette, is by his side. Standing over the table is Marie Thérèse Charlotte, daughter of the King and Queen, and sitting by the footstool is the little Dauphin, the heir to the throne. Facing him is the King's sister. Beyond the doorway we catch a glimpse of the Revolutionary guards.

latter part of the 18th century. The rabbits might destroy the peasants' garden and the pigeons eat his grain, but he must not kill them, for they were protected for the lord's hunting. His fences were broken down and his crops trampled in the chase, but the peasant could claim no damages. On top of the dues to king and noble came the dues to the church. These and other obligations were often more irritating than burdensome; they were senseless and unreasonable to an age that was coming to believe through the writings of Voltaire and others in the rule of reason.

But were these conditions any worse in the latter part of the 18th century than they had been before? No, nor were they as bad in France as in some other parts of Europe, but now the people were beginning to think. The writers of the time—Montesquieu, Rousseau, Diderot, and the other "Encyclopedists"—stirred up thought and discontent. (See French Language and Literature)

At last the day of reckoning came. The funds in the national treasury had been exhausted by the costly wars of Louis XIV, and by his extravagance and that of his successors. The \$250,000,000 that it cost France to aid the Americans (1777-1783) was the last straw. Turgot and Necker, ministers of finance, had tried to ward off bankruptcy by cutting down the expenses of the court. But the reckless court, led by the sprightly, frivolous, extravagant queen, Marie Antoinette, would not listen to the word "economy."

These ministers were dismissed and more accommodating ones took their place. Loans were tried, but in the end the foreign bankers refused to lend more money. Public opinion was deeply stirred by the Parlement of Paris, a judicial body which defied the king and refused to register new edicts of taxation.

In 1788 Louis XVI, as a last resort, called a meeting of the Estates-General (see Estates-General). The representatives of the three estates,—nobles, clergy, and common people,—all came to Versailles, not far from Paris, early in May 1789, armed with memorials (*cahiers*) demanding reforms. The grievances named differed, but all demanded a constitution.

With the meeting of the Estates-General on May 5, 1789, the Revolution began. The representatives of the Third Estate led the way. Some of the nobles and many of the clergy joined with them. They changed the name of the gathering from "Estates-General," which represented classes, to "National Assembly," which represented the people of France. When the king shut them out from their usual place of meeting, they took the famous "Oath of the Tennis Court" (June 20, 1789), pledging themselves not to separate until they had given France a constitution. When the king sent a messenger to remove them from their hall, the fiery Mirabeau cried out: "Go tell your master that we are here by the will of the people and that we will be removed only at the point of the bayonet." Such boldness was portentous.

Paris 14 miles away was alarmed by rumors of the gathering troops about Versailles. A Paris mob stormed and captured the old royal prison in Paris called the Bastille on July 14. Here for generations kings and ministers had imprisoned men and women at will. Soon after its thick walls were demolished as a symbol of the overthrow of despotism and the date of its capture became the French national holiday. When the king in Versailles was informed of what had taken place he exclaimed, 'Why this is a revolt!'

No more was the reply: it is a revolution. After the fall of the Bastille a revolutionary committee of middle-class citizens governed Paris. A national guard composed mainly of citizens was organized and placed under the command of General Lafayette. Then the provinces followed the lead of Paris and formed revolutionary governments. The peasants in many places burned the castles of the lords in order to destroy the papers which contained the records of the lords' manorial rights. Spontaneous anarchy prevailed in many country districts.

Nobles Renounce Their Privileges

A report of the peasant outbreaks made a wonderful impression on the Assembly. Some liberal nobles in that body set the example of renouncing their feudal rights. Amid the wildest enthusiasm men weeping and embracing each other one noble after another gave up some exclusive privilege until finally a decree was passed which aimed at abolishing the feudal system entire. That wild night of Aug. 4, 1789 saw the beginning of Equality though remnants of feudal dues kept the peasants uneasy until 1793.

But what had become of the constitution on which the Assembly had promised to France? Work on it progressed piecemeal and it was finally finished in 1791. Nobility was abolished. France was made a limited monarchy with a one-house legislature. The immortal part of the document was the Declaration of the Rights of Man. It included the following points:

- 1 All men were born free with equal rights.
- 2 All citizens have the right to take part in electing representatives to make the laws.
- 3 Every person shall be free to speak, write or print his opinions provided he does not abuse this privilege.
- 4 The amount of taxes which a person is called upon to pay shall be based on the amount of wealth that he possesses.

The Declaration of the Rights of Man came to be regarded as the charter of democracy. The equality of all men in the eyes of the law is its essence. Property was inviolable for the chief supporters of the new order held property or desired to hold it.

Overthrow of the Monarchy

If the king had possessed the courage—the moral backbone—and the vision to put himself at the head of the movement France might be a monarchy today. But he was only a well intentioned blunderer. At first he did promise to obey the constitution of 1791 which placed a narrow limit on his power. But then

he listened to evil counselors. Many nobles had fled before the storm. These *émigrés* as they were called later headed by his own brothers were in Germany, Austria and Switzerland appealing to the princes of Europe to stop the Revolution in France and threatening a reign of bloodshed when they returned. The people of France apparently with good reason mistrusted the king and still more Marie Antoinette the Austrian woman. In October 1789 a disorderly mob of women and men had brought them—and the Assembly with them—from Versailles to Paris that they might be more closely watched. The suspicions against them were changed into certainties for most of the people in June 1791 when the king and queen with their children sought escape in flight. They were captured at Varennes on the edge of the Argonne just before they reached the border of France. They were brought back to Paris and from that day the monarchy was doomed.

These events hastened the division of the revolutionists into two parties: the constitutional royalists and the republicans. The new Legislative Assembly which met as soon as the king had accepted the constitution (September 1791) still wanted to preserve the monarchy. But the republican sentiment increased rapidly as the king's weakness became more apparent.

On Aug. 10, 1792 a mob invaded the Tuileries, killed the guards and forced the royal family to seek refuge in the hall of the Legislative Assembly. On Sept. 21, 1792 a decree was passed that royalty was abolished in France and a republic was proclaimed. Four months later Louis XVI was sent to the guillotine, a beheading machine named for the physician whose recommendation brought it into use.

The Clergy Oppose the Revolution

The overthrow of the monarchy was not entirely due to the weakness of the king. Affairs generally in France seemed to be going from bad to worse. The clergy and many devout Catholics had withdrawn their support from the Revolution because of the laws against the church. First of all the church property had been taken by the state; this was a financial measure and generally approved. Then the Civil Constitution of the Clergy was drawn up according to which all clergy from bishops to parish priests were to be elected and all must take an oath to support the government. The lower clergy drew back and the only four bishops took the oath. By a blunder the Assembly had divided the patriots who had supported all changes up to this point. Others especially merchants and tradesmen were irritated by the paper money (*assignats*) with which the country was flooded and which soon became worthless. Royalist uprisings were occurring in some provinces as in the Vendée. And at the same time that these dangers were threatening the Revolution within the country, Austria and Prussia having finished the partition of Poland were allied and hostile to the new order in France which threatened the old order everywhere in Europe. England was drawn into the war when the

THE REIGN OF TERROR FEEDS THE GUILLOTINE



A mob jeered the aristocrats whose heads were soon to roll from the guillotine (the raised platform that can be seen at the

left of the picture). Later, some of the revolutionist leaders themselves were either assassinated or decapitated on the guillotine.

French revolutionary armies occupied the Austrian Netherlands (Belgium).

To guide the Revolution through this crisis a strong government was needed. For this the people of France sacrificed liberty. A "convention" was called to draw up a new constitution, and for three years (1792-95) a committee of this assembly, the Committee of Public Safety, ruled France while the constitution was set aside. The power of this committee did not come from the Convention, but from the radical Jacobin club. Its members in the Convention were known as the Mountain, from the high seats which they occupied in the hall of the Legislative Assembly (see Jacobins).

The men in power were Danton, Marat, and Robespierre until Marat was struck down by Charlotte Corday. Through agents and spies and "deputies on mission" the Great Committee spread its net over the whole country. It maintained its position by terror, and so the period is known as the Reign of Terror. Royalist uprisings were sternly put down, and thousands were sent to the guillotine, Marie Antoinette, Madame Roland, aristocrats and tradesmen, atheists like Hébert, finally even Danton (because he urged moderation), were executed, usually with a mock trial or none at all. Old institutions were changed. The worship of the Goddess of Reason supplanted religious services in the Paris churches. The calendar was

made over, 1792 becoming the Year I, the first year of the French Republic. Even the names of the months were changed.

The Terror accomplished what it set out to do. The Prussian-Austrian invaders had been turned back at Valmy on Sept. 20, 1792. Then the French armies carried the war across the borders. "All governments are our enemies," cried an orator of the Convention. "all peoples are our friends." Belgium, Nice, and Savoy were added to France. Under Carnot, called the "organizer of victory," 14 armies were put in the field. The cry went up for the natural frontiers of France, and the revolutionary regime was going back to the policies of Louis XIV.

The Downfall of Robespierre

At length the enemies of the Revolution at home and abroad seemed to be suppressed. Only Great Britain and Austria continued the war. The people were tired of the Terror. When Robespierre showed no signs of stopping the bloodshed, the rest of the Convention took matters into their own hands. Danton had predicted, "Robespierre will follow me; I drag down Robespierre." Robespierre was arrested and sent to the guillotine on July 27, 1794. People then and afterward blamed him for all the horrors of the Reign of Terror, but much of the blame, as well as the credit for it, belongs to others.

More moderate men now governed France. The Convention wrote another constitution—the third since 1789 and the second to be put into operation—then prepared to dissolve. A mob protested against two thirds of the new assemblies being drawn from the hated Convention. A young artillery officer Napoleon Bonaparte protected the new government. He was practically unknown but before long his history became the history of France.

The new government the Directory proved unable to meet the problems within disorganized France. The glory of foreign victories won under the Directory was due to Bonaparte. On Nov. 9, 1799, he helped to overthrow the Directory and replaced it with a Consulate of three members. He was the First Consul and actual ruler of France. In 1804 he discarded pretense and called himself Napoleon I, Emperor of the French. "Liberty was gone," Napoleon himself declared. "Liberty is a necessity felt only by a not very numerous class. It can therefore be restricted with impunity. Equality on the other hand pleases the multitude." (See Napoleon I.)

Few events in history so powerfully influenced the life of modern peoples as did the French Revolution. On the whole that influence was for the public good. (See also articles on chief revolutionary leaders.)

FRESNO CALIF. The 'rain center' of the United States is Fresno. It lies in the flat San Joaquin Valley about 162 miles southeast of San Francisco. It is surrounded by fertile irrigated fields that produce bumper crops of grapes. The grapes are crushed to make wine and dried to make raisins. Other important crops are figs and cotton. The city has about 300 industrial establishments, many of which process the products of the land.

Because the Fresno area was hot and dry (it has an rainfall of only 9½ inches a year) the Spanish and Mexican settlers avoided it. Sometime in the 1800s a Dutchman named A. J. Manssen settled here and dug a well. He was joined by a few other settlers

IN THE HEART OF THE SAN JOAQUIN VALLEY



Fresno is the marketing and shipping center for a fertile irrigated area that produces grapes, figs and cotton.

Fresno a real start came in 1872 when the railroad pushing southward through California's Great Valley reached the site. A townsite was laid out and named Fresno (Spanish for ash tree) after the county. In 1874 the people of Millerton, seat of the county, voted to relinquish the seat to Fresno because it was on the railroad. Most of Millerton's people moved to Fresno. Fresno's steady growth began with the start of irrigation of the farm lands.

Fresno centers about Courthouse Square. Interesting buildings are the modernist City Hall, the Fresno Memorial Auditorium (built to honor the city's veterans of the first World War) and a Japanese Buddhist Temple. Educational institutions include Fresno State College and Fresno City Junior College.

The largest of the city's five parks is Roeding, on its 157 acres are athletic fields, a zoo and about 600 different species of trees and shrubs. Fresno was incorporated in 1885, adopted a city charter in 1900. It has the commission form of government. (See also California.) Population (1950 census) 91,609.

FREUD, SIGMUND (1856-1939) This noted Viennese doctor was one of the first to explore the causes of a mental disorder called a neurosis and to suggest workable cures. Although Freud's theories were at first disputed, his work became the foundation for present-day methods of treating neuroses by psychoanalysis (see Psychoanalysis).

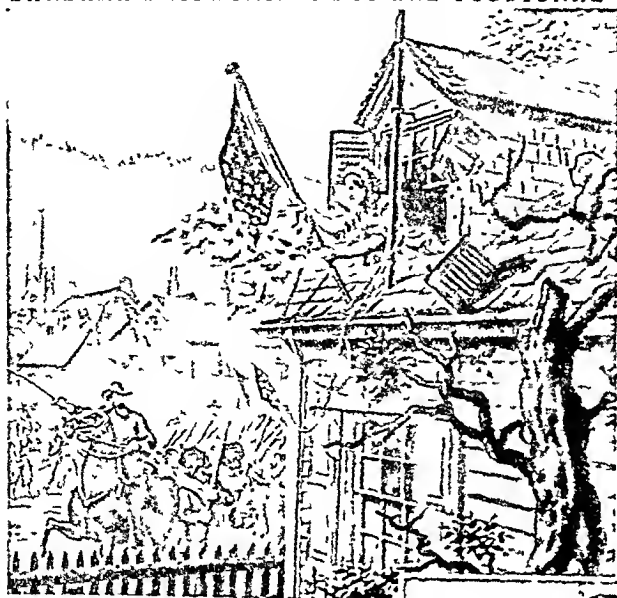


Freud's ideas spread around the world, but he himself traveled little. He lived in the same house in Vienna close to St. Stephen's cathedral for 78 years. There his family had settled when the boy was four. They came to Vienna from Freud's birthplace in Freiberg, Moravia. In school he was an excellent student and rarely had to take examinations.

A youthful interest in science and human personality led Freud to enter the University of Vienna medical school in 1873. He took his degree in medicine in 1881. After serving as intern and resident physician in a hospital, he further studied the nervous system. In 1885 he was awarded a fellowship for a year's study in Paris. There he worked under Jean Martin Charcot, a leading authority on hysteria.

Returning to Vienna in 1886, he began medical practice specializing in nervous diseases. In the same year he married Martha Bernays. They had three sons and three daughters. One daughter, Anna, became a psychoanalyst. The case histories of Freud's patients provided material for brilliant investigations and these brought him fame. In 1909 he visited the United States and gave a short series of lectures.

BARBARA FRIETCHIE—REAL AND FICTIONAL



This scene illustrates the lines from Whittier's poem 'Barbara Frietchie': "Shoot if you must this old gray head, But spare your country's flag", she said " At the right is a picture of Mrs. Frietchie taken shortly before her marriage.

Freud was stern and hardworking in office and classroom, but outside he showed a delightful sense of humor. His hobbies were hunting mushrooms, collecting art objects, and playing card games, often with his grandchildren. When the Nazis invaded Austria in 1938, Freud's books were burned and his theories banned. Friends secured his release from Austria and got him a passport to England, where he was received with great homage. But he had been painfully ill for years, and died in 1939.

FRICTION. Every machine or vehicle must overcome the resistance, called *friction*, which results when one body rolls or slides over another. Whenever you pull a sled or turn a crank, you must overcome not only the forces of inertia and gravity but friction as well (see Physics).

This ever-present resistance is caused by the unevenness of surface found even in the hardest and best polished objects if we examine them under a magnifying glass. The smoother the surface, the less the friction; hence in machines every effort is made to make the surfaces hard and smooth.

Lubricants also lessen friction. This is why automobiles and other machines are provided with elaborate oiling systems. Without oil the heat developed by friction would soon ruin the machines. Furthermore, rolling friction is less than sliding friction. This is why bicycle and automobile wheels and roller skates are provided with ball and roller bearings. Friction is also reduced by bearings made of *antifriction* metals—

various soft alloys which are at the same time hard enough to hold their form against pressure (see Alloys).

Because friction means resistance and never power, we sometimes regard it as a nuisance and a dead loss. Yet a frictionless world would be a strange place. It is friction that enables us to transmit power by pulleys and stop trains by brakes. Without friction, streetcar and railroad wheels would spin around without advancing, as they sometimes do when there is ice on the rails, and any amount or any form of effort would be fruitless. Friction in the wrong place is a dead loss; but in the physical world we would never get anywhere if we didn't encounter resistance—friction—on the way. (See also Lubricants.)

FRIETCHIE, BARBARA (1766-1862). At the height of the Civil War, John Greenleaf Whittier published a poem called 'Barbara Frietchie'. It was about a woman of Frederick, Md., who defied "Stonewall" Jackson, the Confederate general, to make her lower the American flag. Barbara Frietchie was a real person. But historians doubt that the incident actually took place.

Mrs. Frietchie was born Barbara Hauer on Dec. 3, 1766, in Lancaster, Pa. While Barbara was still a child, her Pennsylvania Dutch family moved to Frederick, Md. The exciting days of the Revolution and the forming of the new republic filled the girl with patriotic spirit. When George Washington died she was a pallbearer at the memorial service held in Frederick. At 40 she married John C. Frietchie, a glovemaker 14 years her junior.

When the Civil War started, Maryland did not secede from the Union, but many of its people favored the South. But Barbara Frietchie vigorously supported the Union. She tried to dissuade young men from joining the Confederate army and she criticized her neighbors for sympathizing with the South.

What actually happened on Sept. 10, 1862, is a matter of dispute. Mrs. Frietchie was 96 and an invalid. Perhaps the old lady actually did wave an American flag at the soldiers as an act of defiance. More likely, as Mrs. Frietchie's niece later suggested, she mistook them for Union troops. Jackson, war records show, never passed her cottage. She died three months later, and so her version of the incident was never told.

Whittier got the story he used in the poem from a novelist, Emma Southworth. Both thought the account was true. Later, indignant Southerners denied the story and demanded that Jackson's honor be cleared. Whittier admitted that he might have been wrong in his facts, but not in his judgment of Mrs. Frietchie's character.



FRIGATE BIRD The 'man-o-war bird' as the frigate bird is sometimes called is a genuine feathered airplane. Without seeming effort it floats high in the air for hours at a time ascending in spirals or altering its course by so slight a change in the angle of its planes that the movement is not apparent.

There are but two species in this unusual family (the *Fregata*) both tropical birds. The larger of the two occurs in both hemispheres mainly north of the Equator and has been seen rarely as far north

REMARKABLE BIRD OF THE SEA

as Nova Scotia and inland to Iowa. The other species appears in the Central Pacific and Indian oceans.

Frigate birds have long stout hooked bills. The tail is extremely long and deeply forked and the bones are of a pumice structure that makes the body of the bird lighter than that of any other bird of equal wing size.



This picture shows the characteristics of the frigate bird—huge wings, forked tail, enormous hooked beak and helpless little legs. The white bird is shown on the nest.

When spread the long narrow wings measure ten feet from tip to tip. But they have very small legs and are almost helpless on land. Perhaps the most striking characteristic is the air sac of the male which lies along the throat and when fully distended reaches outward to the end of the long bill and downward so as to obscure the breast. It then looks like a great red balloon. When deflated the sac is visible beneath the plumage of the neck. The feathers are black; the female birds, however, have light under feathers.

These birds nest mainly in colonies on tropical islands. The nest of sticks placed on rocks or low bushes contains one or two hen-like white eggs. The birds feed on fish which they steal from gulls, gannets, and terns. In robbing gannets frigate birds display a good deal of strategy. Riding behind coconut trees they sail out to meet the gannets returning with their fish in the evening. In case the unfortunate fishers do not respond at once to the demands of these feathered pirates the latter seize them by the tail and give them a vigorous shake. Then down go the fish from their beaks and down swoop the frigate birds after them. Yet, curiously enough, the birds roost near each other at night as if they were the best of friends.

On islands where they are often disturbed the frigate birds build their nests on the edges of inaccessible cliffs but where they are not molested they

build on the ground. It is about the beginning of January that the males begin the development of that remarkable pouch. A dozen or more will sit on a tree with outstretched and drooping wings with the great scarlet pouch blown up like a boy's red balloon. When a female frigate bird approaches the tree it is considered the proper form to cry 'wou-wou-wou' and clatter the beaks like castanets at the same time shaking the wings. This performance continues throughout the mating season from January until April. Scientific name *Fregata magnificens*. (For picture see Calápagos Islands.)

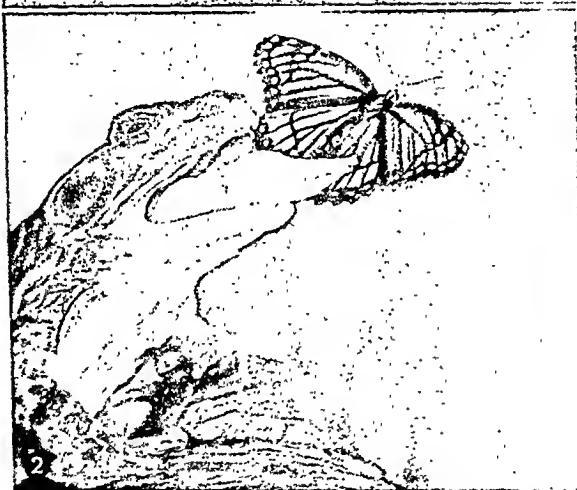
FROEBEL (fró-bél) FRIEDRICH WILHELM (1782-1852). It was not until Froebel the great German educator was 50 years old that he found his real life-work—the kindergarten—and yet the various occupations to which he gave his youth and manhood were in a sense a necessary preparation for it. His uncongenial boyhood home turned his thoughts early to lonesome neglected children. The years which he spent at his uncle's house as apprentice to a forester must have filled his heart early with the love of nature which colors all his thinking. Surveying, clerking, architecture, studying at the University of Jena gave him the various sorts of experience which helped him to understand all kinds of people.

In his early twenties Froebel was engaged to teach in Herr Gruner's school at Frankfurt. He realized immediately that he loved the work, being as someone has said a teacher by the grace of God. He said in spite of his success that there was much for him to learn and so he spent several years studying with Pestalozzi the Swiss educator and at several German universities. He even volunteered as a soldier against Napoleon so that he might never ask his pupils to do a thing which he had not done himself.

For two years after the Peace of Paris in 1815 he was curator of crystals at the museum of the University of Berlin. That life however did not content him and in 1816 he established his first school. It was not until 1830 that he founded the sort of school that has had so wide an influence on education all over the world. That was the kindergarten—children's garden in English—a school for children between the ages of four and six. The great idea which he developed in his books and in his schools was that children must not be taught by rule but according to their natural instincts and activities. The kindergarten bases its teachings on play because that is what little children do naturally.

But Froebel did not live to see his idea fully accepted. The Prussian government abolished kindergartens in 1831 because the authorities considered them socialistic. Froebel died the next year considering his life a failure. But as is often the case with men of new ideas the teaching which he had thought out lived on. Some of his opinions have been discarded but his work has still a great influence on education and the establishment of kindergartens all over the world. (See Kindergartens.)

THE AMAZING ACTIONS OF A COMMON FROG



1. With air from its lungs, a frog inflates its tongue and aims it at the butterfly. 2. The air pressure inside flips the tongue forward until it touches the butterfly, which sticks to the tip. 3. When the air is withdrawn, the tongue flips back, depositing the insect right in the frog's throat. Each picture was taken in only $1/2,500$ of a second, for the entire action is faster than the human eye. 4. Here we see some of the typical motions of a frog swimming under water.

All about FROGS and POLLIWOGS



Each egg is spherical black above light below and about one-sixteenth of an inch in diameter. When first laid the mass is as large as a teacup but it swells up with water to several times this size by the time the eggs hatch. It is hard to believe that so large a mass was all laid by a single frog. Let us watch one of the eggs. It hatches out into a stumpy pollwog. A few days later it has grown gills for breathing and a pair of

A lucky camera shot caught this bullfrog leaping through the air.



FROG Frogs are first cousins to toads and second cousins to salamanders. They all belong to the class of backboneed animals known as Amphibia which means that they are prepared to live both in water and on land. They all have in common a moist clammy skin without scales, all lay their eggs in water in jelly like masses, and all pass through a tadpole or pollwog stage.

Frogs of one or more kinds are found in all parts of the United States except where it is very hot and dry. The most widely distributed and most abundant is the very common leopard frog which is found throughout the country east of the Rocky Mountains. It has irregular rows of black spots all over its back and legs. The underside is light as in all frogs. We may follow its life as an example of frogs in general in order to learn many things about these fascinating creatures.

TREE FROGS



horny beaks with which it rips off bits of pond vegetation and gobbles up great amounts of mud for the small pieces of food it contains. The tadpole is really very much like a fish with many fishlike habits.

So it lives and grows till it is a powerful full grown tadpole three or four inches long—in eight weeks or less if the weather is warm, ten weeks or more if the

weather is cool. Then the fat pollwog begins to show remarkable changes. He has been living like a fish. Now he is going to be a real frog. He swims to the edge of the pond and begins to sniff air into his lungs. As he sniffs more and more his lungs grow larger while his gills get smaller and disappear. In the mean-

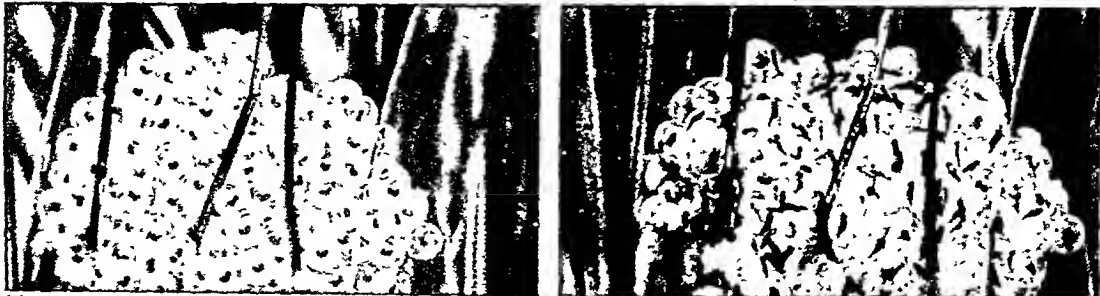
time he has sprouted a pair of hind legs and also a few days later a right front leg and then a left front leg. His long powerful tail gets shorter and shorter till it is all absorbed.

They look as if they had on gloves that were too long in the fingers don't they? But those bumpy ends are suckers with which the tree frog clings to the underside of leaves and other smooth surfaces.

Let us begin at the beginning and look for the eggs in water a foot or less in depth in the oozy quiet places at the edges of ponds and small lakes. Here in March in the south but in April and May farther north both males and females gather for the annual egg laying two or three weeks after the winter's ice has thawed. We may locate them by the low croaks of the males. Usually in the night or early morning the female lays her yearly batch of eggs enclosed in a single mass of jelly and attached to a pond plant of some kind. A small frog may lay 2,000 to 3,000 eggs a large one 6,000 to 8,000.



THE LIFE OF A FROG FROM THE JELLY EGGS TO THE JUMPING STAGE



The seven pictures on this page are seven chapters in one of the strangest of the romances of Natural History—the "metamorphosis" of a Frog. Beginning as masses of jelly-like eggs attached to pond plants, as shown at the left, the little Polliwogs soon wriggle out into the world, as we see in the picture on the right.

and he is prepared for his life on land. Because of the absorption of the tail, it has been said that a tadpole is "a bottle baby, and cannot lose his bottle until he is through with it."

Many other interesting changes take place in the polliwog, during his "metamorphosis" into a frog. One of the most striking is in the intestine. When the polliwog is fattening himself, his intestine is from two to three feet long so that he can absorb nourishment from the masses of coarse stuff he eats. But when he becomes a small frog, this intestine shortens to two inches. As a frog, he will not need a long intestine, for he will have a nutritious diet consisting of flies, mosquitoes, other insects, and worms.

If the weather is warm, these changes take place within a week or less; if it is cool, they may take two weeks or more.

The young frog is still only about as large as the end joint of a man's finger, but it has all the features of a grown-up frog. It has a smooth moist skin, with spots, and large prominent eyes of great beauty. Back of the eyes are the smooth drumheads of the ears. The mouth has a wide gape, with teeth on the upper jaw and in two small groups on the roof of the mouth. The long tongue is attached at the front end and extends back into the throat. It can be flipped out with great rapidity and precision to catch prey. The arms are small with four fingers on each hand, and the legs are large and powerful with five long webbed toes on each foot.

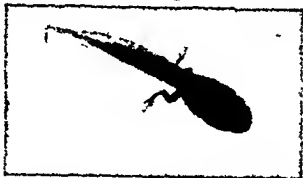
From now on the frog lives in the vegetation of marshy places, always near the water.



Now the heads have grown larger and the tails longer.



A Polliwog begins to sprout his two hind legs.



Here these feet have already become decidedly froglike.



And now along come a pair of front legs, and he has evidently made up his mind to be a Frog.



At last the change is complete, the tail has disappeared, and here he sits as if for inspection.

From time to time he may "plunk" into it to escape his enemies. He absorbs water through his skin and stores it in his bladder, to keep his body moist. When the autumn frosts come he must bury himself in oozy places to "hibernate" or pass his long winter sleep. And in the spring the eggs are laid by the female in the water again.

The frog feeds and grows through his first summer, then passes his first winter sleep. The second summer he feeds and grows again, and sleeps again the next winter. He comes out the next spring for the first egg-laying, but he is not full grown till he is about five years or more old. After that how long does he live? No one knows very accurately, but a good many years—perhaps 10 or 20 or 40, if he is lucky enough to escape so long from freezing and drying, and from the snakes and herons and muskrats, and all the other enemies that destroy small frogs and big ones. From the beginning of his life to its end the frog is a wonderfully fascinating creature, and likewise a very useful one. For he captures and gets rid of thousands of mosquitoes and other insects of many kinds that pester man and other animals. Besides, frogs' legs are regarded as a great delicacy for eating. So many bullfrogs are caught for market that they are becoming scarce in some places. Efforts are being made to raise them in enclosed marshes and pools, called frog farms. Frogs are also used for experimental purposes in biological laboratories. To keep the supply from depletion, laws have been passed

The TADPOLE who WANTED to be a FROG

A Story of Life in the Pond



'What
an odd
looking
creature'
said
Tiny

On a day in early spring Croaker Frog sat under the drooping branches of a willow tree near the edge of Shady Stream. He was a fine looking young frog with his coat of green and his white vest. On this spring morning he felt very happy as he sat there enjoying the feel of the warm air and the sound of the wind in the trees.

All through the long cold days of winter he had slept in the mud at the bottom of Shady Stream. When the first warm wind came down over the hills and the snow and ice began to melt, he had awakened. He was very glad that spring had come, and very glad indeed to be hopping about once more.

This morning he had hopped up and down the bank of Shady Stream for quite a while. By and by he grew tired so he sat down on a large flat stone under the willow tree and closed his eyes.

He had not been sitting there long when three little black tadpoles came swimming by. Seeing Croaker Frog, they stopped to look at him.

'Dear me!' said Tiny, the smallest tadpole. 'What an odd looking creature! I wonder what it is.'

The two other little tadpoles stared at Croaker Frog for a moment. 'I don't know,' said the second little tadpole. 'I don't know at all.'

'I don't either,' said the third little tadpole. 'Just look how his throat trembles whenever he breathes!' said Tiny Tadpole. And just look at his long hind legs! What can he ever do with legs like that, I wonder.'

Just then Croaker Frog opened his big round eyes so suddenly that two of the little tadpoles were frightened and swam away as fast as they could. But Tiny Tadpole was not frightened. He stayed right where he was and said politely, 'Good day, sir! Would you mind telling me who you are?'

Croaker Frog looked down at the little tadpole in the water, and croaked in his deep voice, 'I'm Croaker Frog and I live here in Shady Stream.'

'You do!' Tiny Tadpole said in surprise. 'Why, I live here, too, but I never saw you before.'

'Have you lived here long?' Croaker Frog asked.

'No, I haven't,' Tiny Tadpole answered. 'I haven't lived anywhere very long, because I'm only a few weeks old.'

'Well, I have lived here a long time,' Croaker Frog said. 'I'm sure I've seen you before. Aren't you a tadpole?'

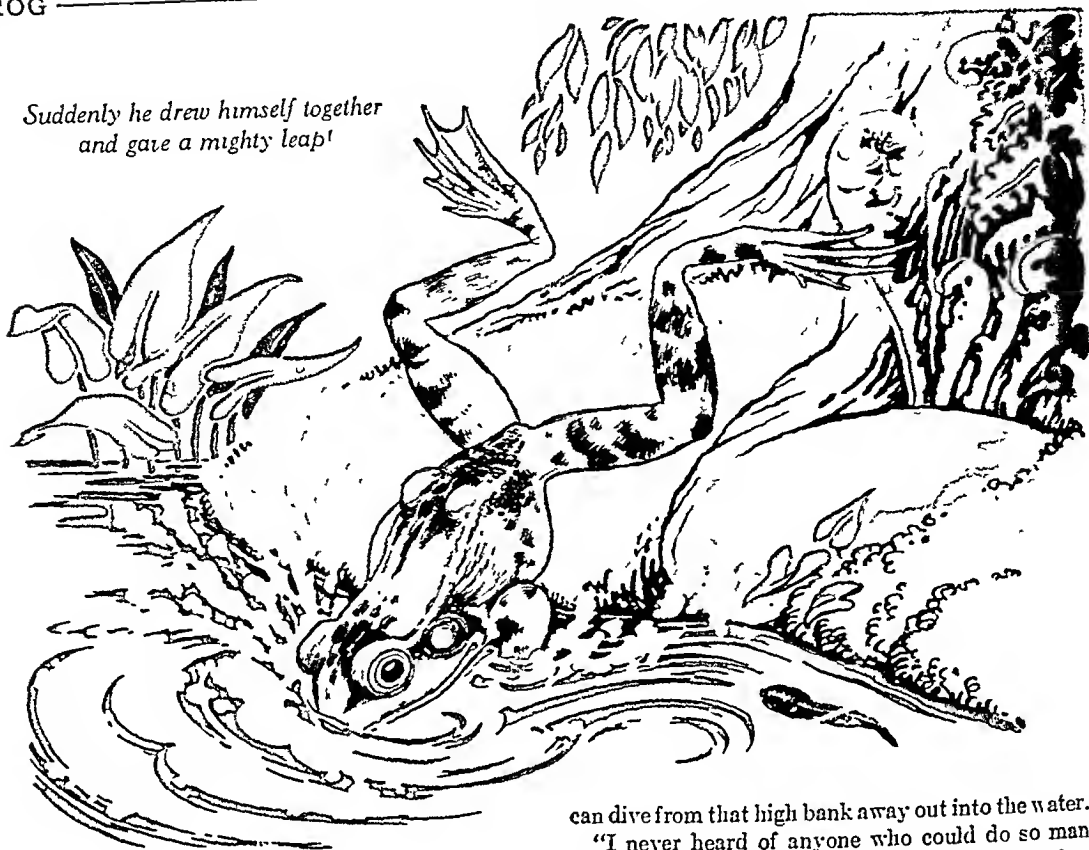
'Yes,' Tiny Tadpole answered. 'That's what I am. Now, I would like to ask you a question.'

'What is it?' said Croaker Frog. 'I will answer it if I can.'

'I would like to know what you do with your long hind legs,' Tiny Tadpole said. 'I never saw legs like those in all my life.'

'I use them to swim with, and I use them to hop with,' Croaker Frog told him. 'I can hop very far and very fast,' he added proudly.

*Suddenly he drew himself together
and gave a mighty leap!*



"Can you, indeed?" said Tiny Tadpole. "Let's see you do it!"

Croaker Frog hopped along the bank and back again so fast that it almost took the little tadpole's breath. "Mercy!" he said. "I wish I could do that. What else can you do?"

"Well, for one thing," Croaker Frog said, "I can sing, because I am a male frog. Female frogs can't sing. I often sit here in the evening and sing with the other frogs."

"And what else can you do?" Tiny Tadpole asked eagerly.

"I can catch flies and gnats with my tongue," said Croaker Frog, swelling out his sides proudly. "Look!"

He shot out his long notched tongue and caught a fly which was buzzing by.

"Did you see that?" he asked proudly. "Did you see my tongue shoot out? Did you notice that it is hinged at the front end, so I can make it go 'way, 'way out?"

"Indeed, I did," answered Tiny Tadpole. "I wish I could do that. The only thing I do is swim."

"I can swim too," Croaker Frog replied, "and I

can dive from that high bank away out into the water."

"I never heard of anyone who could do so many things!" exclaimed Tiny Tadpole. "But I don't understand about diving. How do you do it?"

"I can't tell you very well," said Croaker Frog, "but I can show you. Would you like to see me dive?"

"Of course I would," said Tiny Tadpole. "I want to find out how it is done."

Croaker Frog hopped up the steep bank. When he had reached the top he sat for a moment, high above Shady Stream. Tiny Tadpole watched him closely.

Suddenly Croaker Frog drew himself together and gave a mighty leap!

Out through the air he went, his long hind legs spread far apart! Tiny Tadpole, looking up at him as he passed high overhead, gave a little wiggle of excitement. "Dear me!" he said. "That's almost like flying!"

Splash! Croaker Frog landed in the middle of Shady Stream, sending up a great spray of water all around him. He made such large waves that the little tadpole was almost washed out on the bank.

"Goodness gracious me!" said Tiny Tadpole. "That was the most wonderful thing I ever saw!"

"It was a fine dive, wasn't it?" said Old Turtle, who came swimming lazily along. "Young Croaker Frog is a splendid jumper."

"I wish I could jump like that," Tiny Tadpole said.

"Do you?" Old Turtle asked blinking his eyes slowly.

"Yes, I do," Tiny Tadpole answered. "I wish I could jump the way Croaker Frog does. I wish I could hop about on the bank. I wish I could catch flies with my tongue. I wish I could sing. I'm just a little tadpole. I can't do anything but swim."

"Well, now, I wouldn't feel too bad about it if I were you," Old Turtle said kindly. "Maybe some day you can do all these things too."

"What do you mean, Old Turtle?" Tiny Tadpole asked eagerly. "Do you really think I will be able to?"

"I shouldn't wonder," said the turtle. "I'll tell you what, suppose you come with me for a little swim. I think I can show you something that will surprise you very much."

"Let's go right away!" cried Tiny Tadpole.

"All right," answered Old Turtle. "Come along!"

They swam slowly away, down—down—down, to the very bottom of Shady Stream. Old Turtle stopped beside the roots of some water weeds.

"Look around you, young Tadpole," he said, "till you see what you see."

"I don't see anything," said Tiny Tadpole, except a lot of little tadpoles.

"Do you see anything queer about them?" Old Turtle asked.

Tiny Tadpole looked at them closely. "Why they haven't any eyes or any mouths have they, Old Turtle?"

"No," answered Old Turtle, "they haven't. But how do they eat?" Tiny Tadpole asked in surprise.

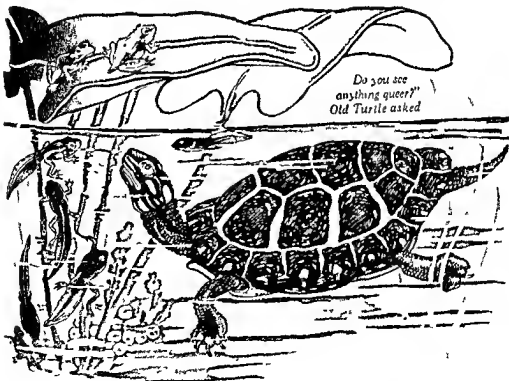
"They don't eat. They aren't hungry, so they don't eat. They just lie here at the bottom of Shady Stream and wait. But in a day or two their eyes and mouths will grow—just as yours did."

"What! Didn't I have any eyes or mouth at first?" Tiny Tadpole asked.

"No, you had no eyes and no mouth. You came out of an egg, you know, just as all little tadpoles did, and at first you didn't do anything. You lay here on the bottom of Shady Stream and just waited, like these little fellows."

"Did I?" asked Tiny Tadpole. "I've forgotten all about it. Isn't that strange?"

"Yes, it is," said Old Turtle, "but something even stranger than that is going to happen to you soon, young Tadpole."



"What is it? What is it?" Tiny Tadpole said, wiggling his little tail very fast. "Please tell me quick, Old Turtle!"

"I will show you what is going to happen to you if you will come with me," answered the turtle, and he swam away.

Tiny Tadpole swam after him as fast as he could, and presently the turtle stopped again.

"Now tell me what you see," he said.

Tiny Tadpole looked around him. There, among the pickerel weeds, were the oddest little creatures he had ever seen. He stared at them for a moment without speaking. "Why," he said at last, "you are tadpoles, aren't you?"

"I suppose we are," one of the odd little creatures answered. "At least we *were* tadpoles only a few days ago. But see what is happening to us now! It is something very strange; something we don't understand at all. Look at us closely. See! Each one of us is growing a pair of hind legs!"

"So you are!" cried Tiny Tadpole. "Why are you doing that?"

"I'm sure I don't know," the little creature said slowly. "Do you know, Old Turtle?"

"Yes," said Old Turtle, "I know why you are growing hind legs; you are turning into frogs, that's why. Pretty soon your front legs will grow too, and then you will lose your tails."

"Lose our tails!" cried the little creature. "Won't it hurt?"

"Not a bit," said Old Turtle. "They will just get a little shorter and a little shorter each day, and then you will be frogs and can hop and dive and swim."

"Oh!" cried Tiny Tadpole. "How wonderful! I wish I could be a frog."

"You will, because you are a tadpole," Old Turtle said. "One of these days, you, too, will lose your tail and your legs will grow. Then you will be just like Croaker Frog."

"Will I?" asked Tiny Tadpole cagerly. "And will I be able to hop very far and very fast?"

"Yes," Old Turtle told him.

"And will I be able to dive?"

"Yes, you will do that too."

Tiny Tadpole swam very close to Old Turtle. "And will I be able to *sing*?" he asked anxiously.

"Yes," Old Turtle said, "of course you will."

"Oh! Oh! Oh!" Tiny Tadpole wiggled all of his little body. "Do little tadpoles always turn into frogs? Do they, Turtle?"

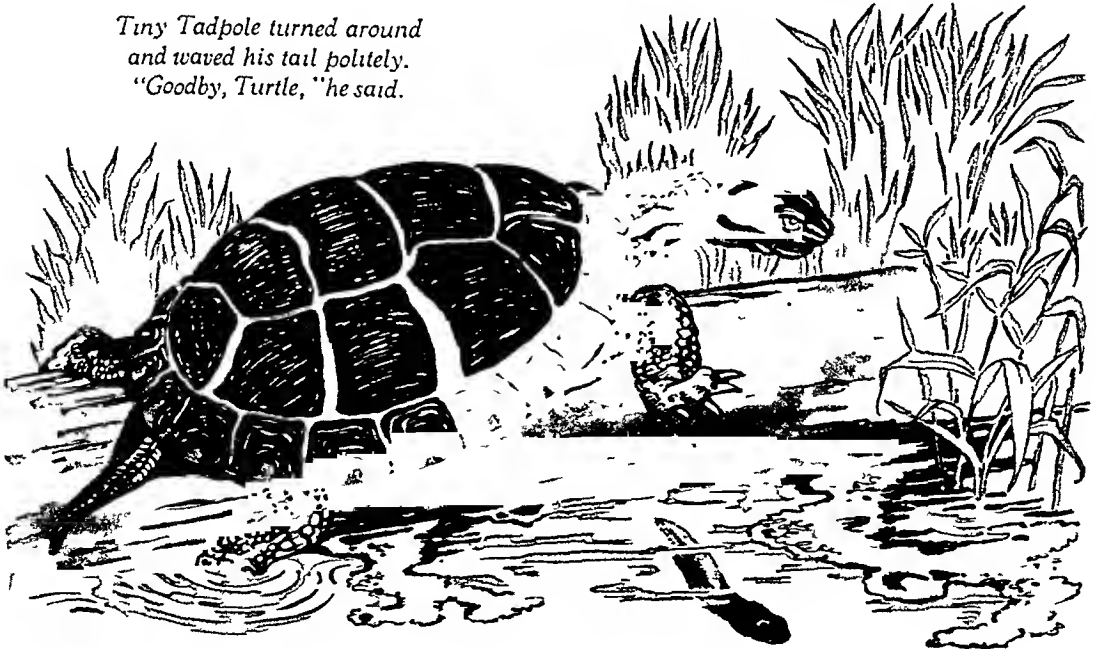
"Yes," Old Turtle answered.

"Well, that is the very most wonderful thing I ever heard," Tiny Tadpole said. "I am going right now to tell all the other little tadpoles."

Tiny Tadpole turned around and waved his tail politely. "Goodby, Turtle; and thank you very much for telling me," he said.

"Goodby," said Old Turtle, and swimming to the bank of Shady Stream he climbed out on a log and went sound asleep.

*Tiny Tadpole turned around
and waved his tail politely.
"Goodby, Turtle," he said.*



making it illegal to catch frogs for market during their breeding season.

Different Kinds of Frogs

There are about three dozen kinds of frogs in this country differing from the leopard frog mostly in size and the spotting of the skin. The 'big peepers' are not as large as the end joint of a small finger. As soon as the ice in ponds melts in the spring the peepers begin their shrill songs. Their tiny eggs are laid at very rough the same times and places as those of the leopard frog. The tree frog is also interesting with its rather doleful song and its changes of color—light ashy gray brown bright green—in imitation of its surroundings. Its eggs are laid in late spring. In contrast is the great southern bullfrog as large as a double fist. Its hoarse drumming sound can be heard for a half mile. It was in its first winter as a tadpole as does also the smaller green frog.

The frogs west of the Rocky Mountains belong to different species from those east of the Rockies but are not very unlike them. In tropical regions some of the frogs lay their eggs in damp places and the young are hatched as small frogs.

Frogs and toads belong to the order *Salientia* of the class *Amphibia*. Scientific name of the leopard frog *Rana pipiens* of green frog *Rana clamitans* of bullfrog *Rana catesbeiana* of peeper *Hyla pickeringi* of tree frog *Hyla versicolor*. (See also Toad.)

FROISSART (froi' sart) JEAN (1337-1410?) As a historian and poet of the Middle Ages, Froissart vividly felt, long before Shakespeare lived to say it, that "all the world is a stage." He lived at a time when that stage was particularly lively, when the curtain rose on great castles and tall cathedrals when armored knights on strong war horses trod the earth, and chivalry and poetry were in the air.

Froissart gloried in this life in its gorgeous pictures and heroic deeds. He sang of it in poetic ballads, and he wrote a history, his famous 'Chronicles', dealing with events from 1326 to 1400 which gives us our most vivid accounts of the superstitious romantic, warring world of that time. It is from him especially that we get our account of the Hundred Years War, with its picturesque battles of Crécy and Poitiers. Often his stories contradict one another, and there is no doubt that his imagination filled in the barren spots where facts were wanting. He never let uncertainty spoil a good story and his sympathies are always with the lordly knights rather than the humble townsmen and peasants. But his 'Chronicles' are faithful to the spirit and pageantry of those days even though he was sometimes mistaken about just what happened.

To collect the stories which he tells us he wandered on horseback, a greyhound trotting behind through many lands. The queen of England wife of Edward III the Scottish King David Bruce and the Earl of Douglas the Duke of Clarence in Italy the Duke of Brabant and the Comte de Blois were all among his

friends and patrons. During his travels he talked with lords and knights, squires and heralds and jotted down from their unreliable lips tales of the court and the battlefield. In his youth he was educated for the church and in his old age the Comte de Blois made him canon of Chumay and there was ended the adventurous life of this knight errant of history' (See Hundred Years War).

FRONTENAC (fron' t-n-ak) COUNT LOUIS DE (1620-1698) The savior of New France is the title often given to this French nobleman because it was his efforts that saved the French settlers in the St. Lawrence valley from being wiped out by the Indians. He thus shares with Champlain and La Salle the glory of establishing French power in North America.

Frontenac belonged to the nobility of France and had for his godfather King Louis XIII, whose name he bore. The change from the splendid court of France to the wilderness of Canada to which Frontenac was sent as governor in 1672 was a tremendous one, but he had a passionate love for the soil and a life. As a boy of 15 he had served in Holland and in the 37 years which had passed since then he had frequently fought valiantly for his king in Italy, Flanders, and Germany.

Furthermore Frontenac liked to rule and it was a vast domain which was given to him to govern. He showed his administrative wisdom by attempting to introduce into Canada an assembly of nobles, clergy, and common people, like the Estates-General which had met in France in former times. He likewise tried to give Quebec some measure of local self-government by calling town meetings twice a year to elect aldermen and to discuss public business. But while he was trying to introduce these reforms in the New World the king was busily engaged in suppressing the same institutions in France, and so Frontenac's efforts did not meet with royal approval.

The governor also antagonized many of the leaders in the colony by his imperious and haughty disposition. The traders however, were friendly, because he crushed the Iroquois Indians, the persistent enemies of the French. The story of his struggles and achievements is told in Parkman's 'Count Frontenac and New France' and Le Sueur's 'Count Frontenac'. Because of difficulties with the Jesuits and others he was recalled to France in 1682. When the colony was involved in a new war between France and England (1689) he was sent back as governor. This time he not merely defended Canada against English attacks but so lessened the power of the Iroquois that they never again became a serious danger to the French settlements.

FROST, ROBERT (born 1875) The poetry of Robert Frost tells of simple things—of swinging on a birch tree of stopping by woods on a snowy evening of the death of a hired man. But behind them is a deep feeling for life's fundamentals such as love loyalty awareness of nature and of God. Frost wrote of

these matters in plain words. The poetry is in the meaning, not in the language.

Frost was already 38 years old before he published his first book of poems, 'A Boy's Will'. Before then he had earned his living as a farmer and teacher. The book brought him fame. Honors followed over the years, including four Pulitzer prizes for poetry. He held teaching and advisory posts at Amherst, Harvard, Michigan, and other colleges for many years, and these brought him a good income. He won honorary degrees, medals and memberships from various societies, and acclaim as one of America's foremost poets. But Frost continued to live simply and to find poetry in everyday things.

The poet was born March 26, 1875, in San Francisco, Calif. His father was a newspaper editor and politician. He named the boy for his favorite Civil War general, Robert E. Lee. Robert was ten when his father died. The family returned to Grandfather Frost's home in Lawrence, Mass. At first Robert took little interest in school. He preferred to be outdoors in the New England countryside, beautiful in summer, bleak and cold in winter. But in high school he took

ROBERT FROST



Frost created great poetry from plain thoughts and speech.

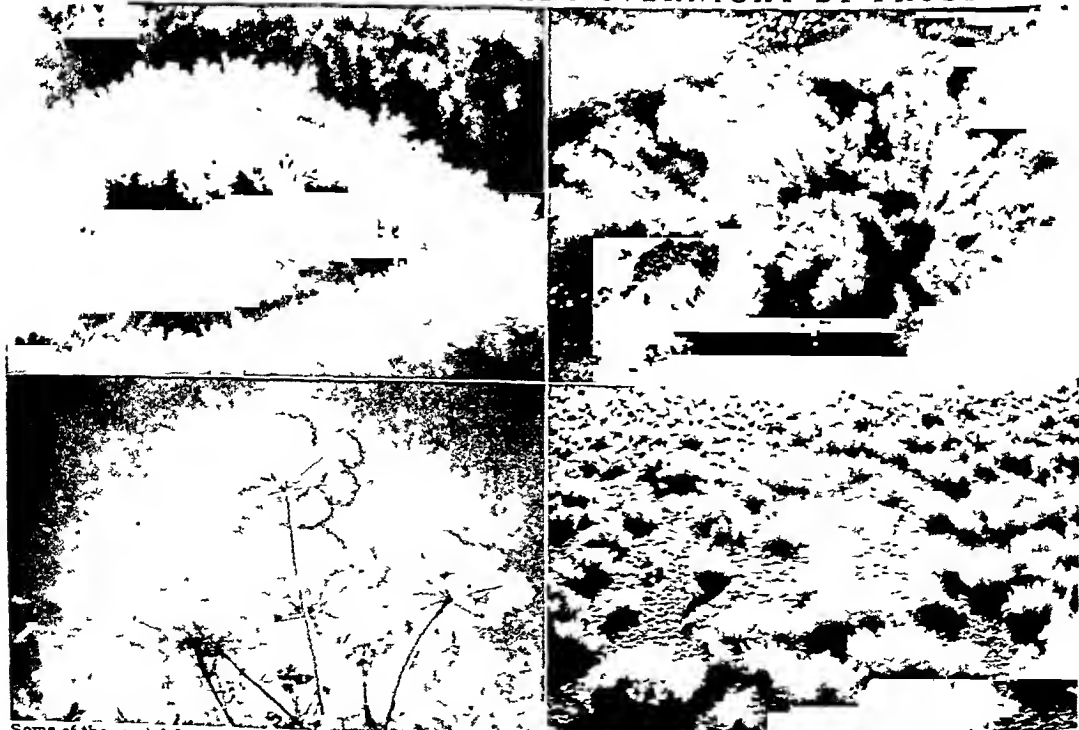
a sudden interest in reading. He shared valedictorian honors with his high school sweetheart, Elinor White. The same year he sold his first poem for \$15.

He tried Dartmouth College for a few months, then worked at several jobs. In 1895 he married Elinor White. He decided to attend college again. He studied for two years at Harvard, then returned to Lawrence. In 1900 Frost's grandfather bought him a farm near Derry, N. H. But Frost was no farmer. After six years of trying to make a living from the land, he became a teacher at Pinkerton Academy in Derry. A few of his poems appeared in magazines, but nobody noticed them. In 1912 Frost sold his farm and moved his family to Eng-

land. The next year a London firm published 'A Boy's Will', and in 1914 'North of Boston' appeared. The Frosts returned to the United States in 1915, and Robert Frost was well launched on his career. Frost farmed in later years, but only as a hobby.

FROST. Most city dwellers think of frost only as a hint of winter or as a crystal pattern on a cold windowpane. But frost is important to the farmer. In temperate climates, it limits his time for both planting

FOUR MASTERPIECES MADE OVERNIGHT BY FROST



Some of the most delicate patterns are made when frost coats a countryside with tiny ice crystals. A whole book could be filled with traceries made on windowpanes alone, and no two would be alike. The first picture in this group (upper left) shows so-called 'ice flowers.' They are star-shaped crystals embedded in masses of ice. The second (upper right) and third (lower left) show frost on plants in a field. The fourth (lower right) shows clusters of fluffy patterns on tufts of grass above a shallow stream. The best time to see frost formations is shortly after sunrise, before they have a chance to melt.

and harvesting. Fruit growers fear unseasonable frost as a swift killer of buds or ripening fruit.

The kind of frost we can actually see is made up of tiny crystals of frozen water. It forms when moisture-laden air is cooled below the freezing temperature of water. This temperature, called the *freezing point* is 32°F (0°C) at sea-level pressure.

When the air becomes cooler it cannot hold as much water as before. The excess water condenses on such objects as the windowpane, the outside of an ice-cold pitcher or on plants. If the cooled air remains warmer than 32°F, the freezing point, the excess water is simply deposited as dew (see Dew). If the temperature falls below 32°, the water freezes into a coating of interlocked crystals. This is often called *white frost* or *hoarfrost*. Usually the air must be still before dew will change to frost. Frost is rarely seen after a windy night.

Sometimes the air is too dry or too windy for visible hoarfrost to form. But if the temperature falls below 32°F during the night, the water inside plants will freeze. Next morning it thaws and the plants turn black. This is sometimes called a *black frost*.

Heavy clouds or fog often prevent formation of frost on plants. They provide a blanket that stops plant

heat from radiating to the open sky. Various artificial ways to protect vegetation from frost have been devised. Some of them imitate natural frost protectors. A light cloth canopy over plants prevents radiation of heat. Smudge pots in orchards cover the trees with thick smoke that holds in the plant heat. Another device to protect plants against frost is a kerosene-burning infrared generator. It sends infrared rays directly to plants and earth and compensates for loss of natural heat.

Crops on hill-sides often escape frost while crops in the valley below are destroyed. This is not caused by cold air flowing downhill, as sometimes supposed. After nightfall all the air cools and becomes denser and heavier. The air in the valley already is as low as it can get. It stays in place and becomes colder. The air on the hillside falls a little because of its weight. It slides out over the surface of the valley as though over the surface of a lake. Warmer air from above settles in its place. In this way the air temperature on the hillside remains higher than in the valley.

Potato growers used to depend on autumn frost to check abnormal growth of potatoes and to kill vines. Now a chemical spray can be used to stop growth at the proper harvest time.

FRUITS of TREE, SHRUB, and VINE

FRUITS and FRUIT GROWING. An important article in our daily diet is fruit. It is rich in vitamins and minerals and is one of our most delicious foods as well. We eat fruits in many ways. They may be fresh, frozen, canned, or dried. They are prepared as fruit juice or stewed fruit. Fruits are made into pies and other desserts and concentrated fruit flavors go into other dishes.

To meet the demand for fruit, a great growing and processing industry has developed. In such states as California, Florida, and Washington, orchards extend for miles. Near the orchards, huge factories process the fruit for world-wide shipment. Scientists constantly experiment with new ways to preserve all the food elements and health benefits in fruit. In addition to older methods of preserving, such research has developed fresh frozen concentrated juice and frozen whole fruits such as berries. (See also Food, Food Preservation.)

How Present Day Fruits Were Developed

When the first European colonists came to North America, they found only a few fruits in the wilderness. The American Indians had a few varieties of crab apples and such berries as strawberries, huckleberries, and mulberries. Today practically every fruit of the temperate zone and many of the tropical fruits grow somewhere in North America.

Some had already been grown for centuries in Europe and Asia. Seeds and seedlings were brought over to give Americans new foods. Other varieties were developed from older foreign and native fruits by special methods. These methods have improved flavor in some fruits. Others have been made seedless, thus

skinned or over size. Some fruit stalks have been freed from spines and thorns.

Many of the changes were made by taking advantage of the way flowers turn into fruit (see Flowers). Changes can often be made by transferring pollen from one species to another. The desirable qualities of both are combined in one variety, called a *hybrid*.

Trees and shrubs grown from the seeds of hybrids and other choice varieties often tend to assume the form and habits of their wild ancestors. This may be overcome by the process of *grafting*. A bud or twig of the choice variety (called the *scion*) is inserted in a cleft cut in the roots or stem of a closely related common or wild plant (the *stock plant*). The joint is then covered usually with cloth and allowed to heal. When the tree grows, it bears the same fruit as the scion.

Large numbers of seedlings are raised to provide the stocks. Choice cuttings are grafted on them in special nurseries. The combined stock and scion are then transplanted to the orchards.

The Modern Fruit Industry

Great changes in the fruit industry have come about by refrigeration and rapid transportation (see Refrigeration). Previously apples were practically the only fresh fruit enjoyed in winter. Pershable fruit could be eaten fresh only in season and in the locality where grown. Now the fruits of the South are regularly shipped to the North when fruits there are not in season, and fruits of many kinds are kept in cold storage warehouses for winter use. Many American fruits are shipped to England and other countries and in return various native fruits are brought from practically every country of the globe—melons, for

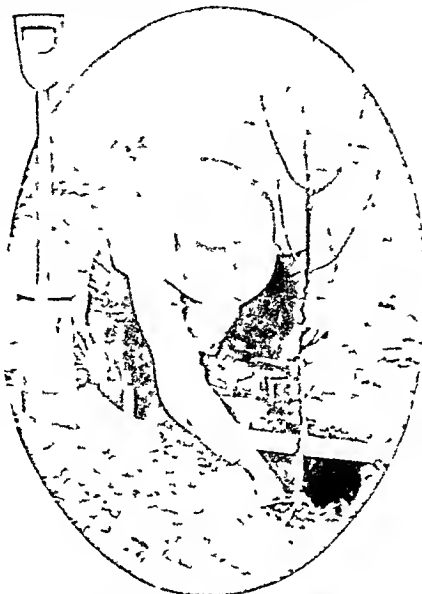
Argentina, olives from Spain and Greece, dates from Iraq, and bananas from Central America, Mexico, Cuba,

and Colombia. Fresh apples, lemons, bananas, and oranges are supplied throughout the year, while pears, strawberries, grapes, and peaches which a half-century ago were enjoyed only for a few weeks are now on the market many months. Bananas were once expensive novelties found only in large seaports. So too the *avocado*, also called the *alligator pear*, has become a standard salad fruit. This native of subtropical America has a rich, oily pulp with a protein content more than twice that of the commoner fruits. First-grade fruit from California is marketed under the trade name *calavo*. Florida and Cuba also grow *avocados* commercially. The *mango* (see Mango) and the tropical *papaya*, or *papaw*, a fruit resembling a small cantelope, are now raised in

Florida and California and are slowly gaining favor in northern markets. Many other tropical fruits are

as yet little known outside the areas where they grow, except in the form of preserves. Such fruits are the

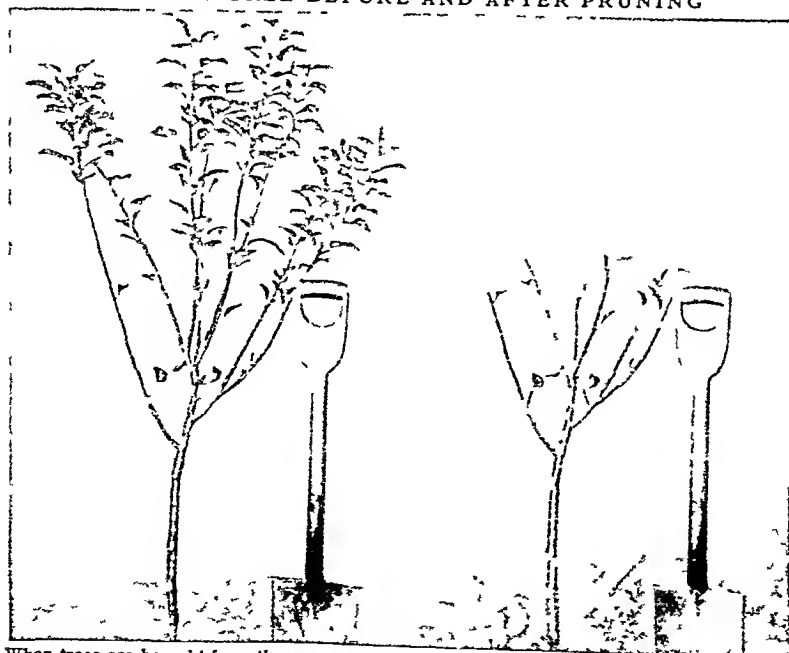
PLANTING A FRUIT TREE



Young trees should be transplanted an inch lower than they were planted in the nursery. A board is used to gauge the depth of the planting.

apple, the small heart-shaped pulpy fruit of a little tree grown in Colombia or Peru; and the *star apple*, a

A YOUNG TREE BEFORE AND AFTER PRUNING

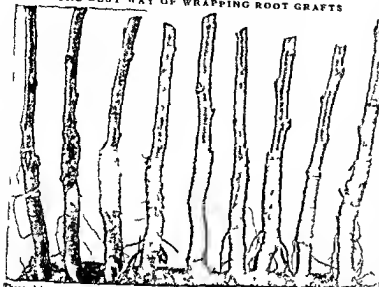


When trees are brought from the nursery, the tops should be cut back so that there will be a balance between the amount of top and the amount of roots remaining. Unless this is done transplanted trees usually do not get on well.

West Indian fruit like an apple in size and appearance with a star-shaped center formed by the seed cells.

While we still have the small fruit garden, and the farm orchard of 50 or more trees, this wider distribution of fruits has developed commercial orchards spreading out over thousands of acres of irrigated land. Thousands of workers are employed on the large projects in picking, sorting or grading, packing, and marketing the fruit. The workers must know their trade and work with nimble fingers. The fruit, picked just at the right time, which is before it is ripe, is carefully handled, wrapped, and closely packed to prevent bruising which might cause the fruit to rot before reaching the market. In most of the fruit areas the grading, shipping, and marketing, even

THE BEST WAY OF WRAPPING ROOT GRAFTS



These pictures illustrate experiments made by the Department of Agriculture at Washington to determine the best method of wrapping root grafts. The materials used were cloth, rubber, waxed paper, plain thread, and waxed thread. One you see was left raw, and another the union was waxed without wrap on. The conclusion from the experiments was that cloth is the best wrapping to use.

berries are found both cultivated and growing wild. Blueberries grow wild in a limited area and their cultivation has only been undertaken as an experiment on a small scale. Cranberries which grow wild in cool climates are extensively cultivated in some of the northern states. Elderberries and the scarlet haws or thorn apples are little known although the wild fruit is used for making jellies. The wild grape, pawpaw and may apple or mandrake are also found in the wildwood.

Starting and Caring for an Orchard

The fruit grower chooses well-drained land for the orchard site with good subsoil to a depth reached by the tree roots. The young trees grown in a nursery are set out in regular spaced rows in the orchard when they are one or two years old. The orchard is cultivated to keep out the weeds and sometimes cover

the advertising is carried on by effective cooperative organizations. They strictly supervise the quality so that the reputation may be maintained and so enable them to market the product at the best rates for the producer.

Chief Fruit Grower of the World

The United States leads the world in quantity and variety of orchard fruits. The largest most valuable and most widely distributed fruit crop is apples grown chiefly in Washington, New York, Virginia, Pennsylvania, California, and Michigan. Oranges rank next though most of the crop comes from but two states, California and Florida. Peaches are usually in third place about half the commercial crop coming from California and Georgia. Grapes rank fourth without counting their products such as raisins and wine. California is by far the leading grape grower followed by New York, Michigan, Ohio, and Pennsylvania. Strawberries most important of the berry crops are grown in Louisiana, California, Arkansas, Oregon, Tennessee, Michigan, Florida, and many other states. Melons, lemons, pears, prunes, and other plums, grapefruit, cherries, apricots, and cranberries are other large commercial fruit crops.

Many native fruits including crab apples, plums, and cherries still grow wild. Berries too such as raspberries, strawberries, blackberries, and goose

are set out in regular spaced rows in the orchard when they are one or two years old. The orchard is cultivated to keep out the weeds and sometimes cover

SAVING A TREE'S LIFE



Rabbits and other small gnawing creatures sometimes chew off a circle of bark around the base of a tree. When a tree has been girdled in this way the sap cannot rise and the tree will die unless something is done quickly to save it. Here a case of the rescue methods called bridge grafting. The tree at the left is newly grafted. In a few years it will look like the tree on the right, for not only do the grafts carry the life giving sap, but they grow along with the rest of the tree.

crops such as clover or alfalfa are grown and then turned under to add nourishment to the soil.

Another important operation in orchard and vine-

SMOKING JACK FROST OUT OF THE ORANGE GROVES



Even in the warm climates where oranges grow, the nights sometimes are cold and Jack Frost is liable to do a good deal of damage if precautions are not taken. Accordingly, little stove-like affairs, such as these, containing oil, coal, coke, or wood, are set through the orchard, and while the heat warms the atmosphere the smoke helps to form a protecting blanket.

yard is that of spraying to prevent injury to the tree or its fruit from insect or fungus pests (*see* Spraying). Pruning is also very necessary to good fruit. By a proper cutting back of wood growth, fruit-bearing wood may be given increased vigor and the tree opened up so the sunshine will reach the fruit. Pruning away dead branches prevents injury to the tree through spread of the decay, removes a natural harbor for insects and other enemies of the trees, and removes weight that would uselessly encumber the tree. Even old neglected orchards may be restored to bearing by proper pruning and care.

Fighting Off the Frost

Frost coming after the trees have begun to bud can do an enormous damage to the orchard (*see* Orange). When warning of an untimely frost is sent out by the weather bureau among the fruit-growers of any region, they act promptly to save their precious trees. Smudge fires are started all through the orchard forming a blanket of smoke overhead to prevent the loss of heat through evaporation during the night. For the same purpose a curtain of vapor may be formed over the orchard by spraying water high into the air, and still another method is to fill with hot water a system of pipes running all up and down the rows of trees to keep the temperature above the freezing point.

Fresh fruits, like green vegetables, contain large quantities of water, and are not substantial foods. But they are important in a well-balanced diet for the vitamins and minerals they contain, and because their acids help digestion. Dried, preserved, and canned fruits hold a very important place in our diet (*see* Food Preservation).

Fruits in the botanical sense are the parts of the plant which contain the seeds. To the botanist, the seed-carrying portions of all plants are fruit, even if we do not commonly think of them as such, so that we may name three main fruit classifications: (1) fleshy fruits, such as berries, oranges, melons, gourds, and apples, with seeds in the flesh; (2) stone or drupaceous fruits containing pits or stones, such as plums, peaches, and cherries; (3) dry fruits, including nuts, grains, legumes such as beans and peas, and capsules, pods, or similar containers such as the seed vessels of flowers. In the fleshy fruits, the whole seed envelop or *pericarp* is fleshy or juicy. In the drupes, the part of the fruit around the seed (the *endocarp*) becomes hard or stony, forming the peach or plum or cherry "pit," while the outer portion (the *exocarp*) is fleshy. Dry fruits may be divided into "splitting" fruits, like peas, beans, and poppy capsules, which break open and scatter the seeds, and "non-splitting" fruits, like acorns, grains, and nuts.



Color-contrast photographs

By Fred Bond

THE APPLE AND ITS RELATIVES

At the top are the blossom and fruit of the apple. Then come its close relatives the pear (middle) and the quince (bottom). All belong to the order of the roses as may be guessed by comparing the blossoms to those of the wild rose.



Direct-color photographs

By Fred Bond

MEMBERS OF THE PEACH FAMILY

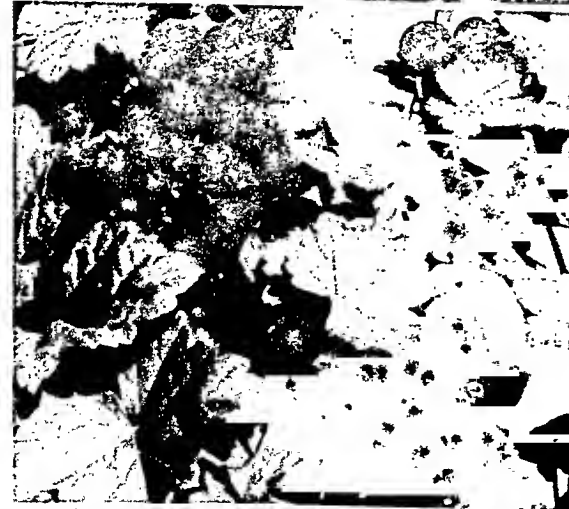
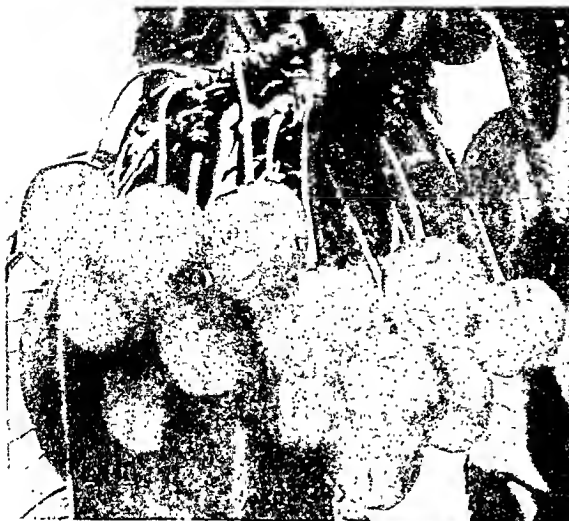
Here are the blossoms and fruit of the plum (top), the peach (middle), and the apricot (bottom). Like most temperate-climate fruits, they belong to the rose order; but they are distinguished by having "stones" or "pits" as seeds.



By Fred Bond

CHIEF FRUITS OF THE CITRUS GROUP

The blossoms and fruit of the grapefruit (top) the lemon (middle) and the orange (bottom) show the close relation between these members of the *Citrus* genus. The flowers look very much alike as do the shiny dark green leaves.

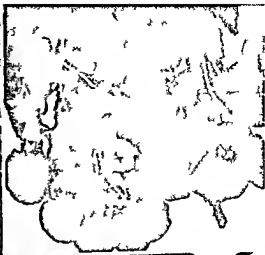


Direct-color photographs

By Fred Bord

SMALL FRUITS OF TREE, BUSH, AND VINE

The cherry (top), with the pit in its fruit, belongs to the family of roses and the same genus as the peach. The grape (middle) and red currants (bottom) are among the few temperate-climate fruits not related to the roses.

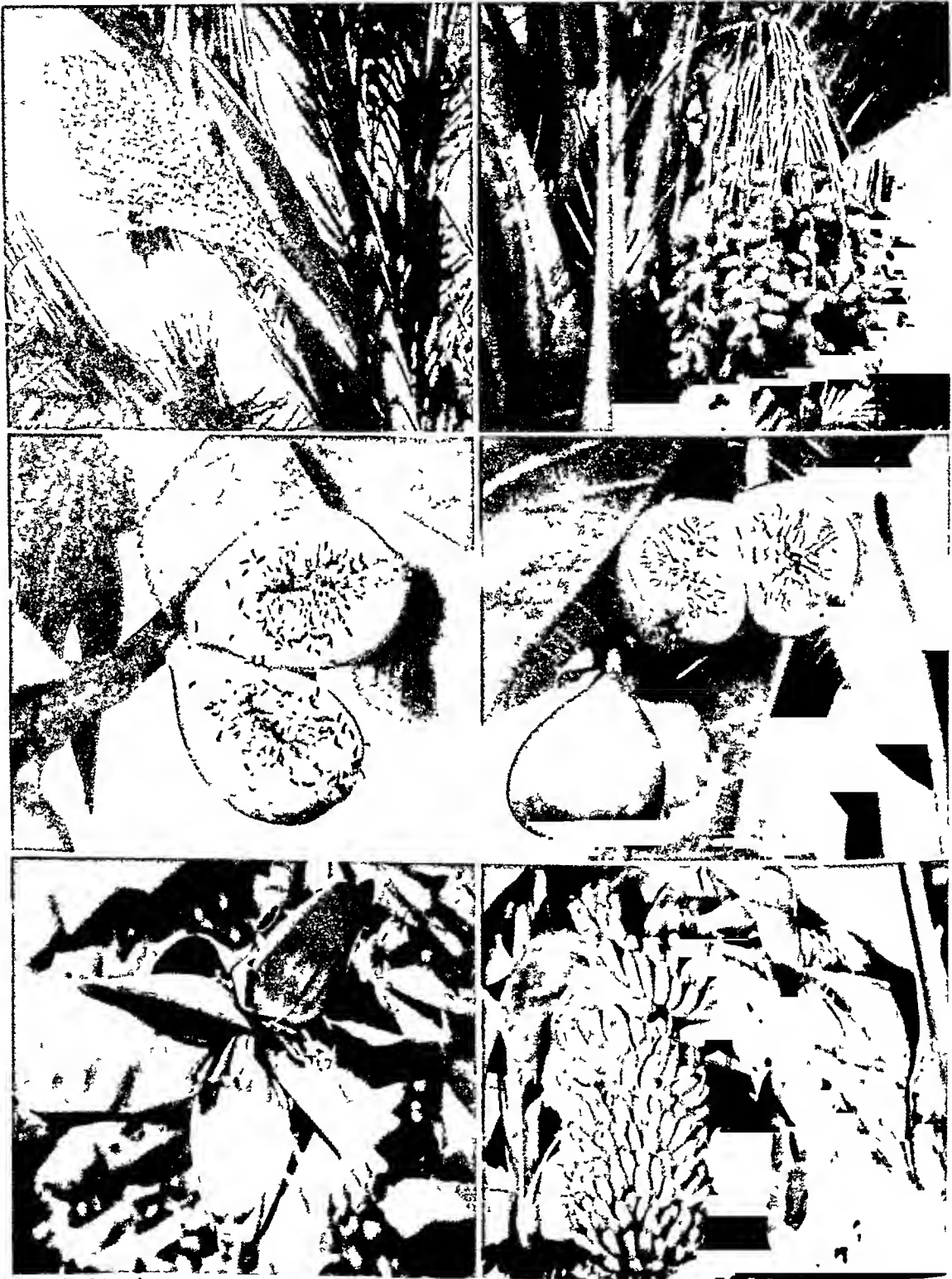


By Fred Bird

BERRY FRUITS OF THE ROSE TRIBE

The accompanying photographs show the raspberry (top), the blackberry (middle) and the huckleberry (bottom). Although the fruits are small and different in shape, the relationship can be seen in the flowers.

Dr. J. H. S. S. S.



Direct-color photographs

By Fred Bond

THREE FRUITS FROM THE TROPICS

Here we have the blossom and fruit of the date palm (top) and of the banana (bottom). In the middle are two types of figs. At the left a caprifig in the flower stage is cut open to show the tiny fig wasps. They had to carry pollen to the edible fig at the right to make it ripen into fruit (see Figs)

FUCHSIA (*fū'shā*) This lovely plant with drooping pendantlike blooms of blue purple rose and white is highly prized for window boxes and garden borders. Most of the common garden types were developed from a specimen brought to England from Chile in 1788. From this specimen and others found in Central America and Peru have come the brilliant plants of today.

Careful selection and cross-pollination have produced a tremendous number of interesting varieties. The nectar of the flowers contains a large percentage of sucrose (ordinary sugar) and the little four-lobed berries are sometimes good to eat. A bluish red dye is obtained from certain species.

The fuchsias comprise a genus of small plants, shrubs and trees of the evening primrose family. The genus is named after Leonhard Fuchs, a 16th century German botanist. There are about 70 species native to tropical America and New Zealand. The common *Fuchsia magellanica* has four petals, usually blue. The eight projecting stamens hang from the throat of a red bell-shaped calyx. In the North fuchsias are grown from cuttings in a greenhouse and are set out after the danger of hard frost is past. The plants ordinarily grow to a height of one or two feet. In mild climates they thrive in the open the year round and they grow to great size when trained against a wall.

FUEL The civilized world today depends on fuel much as the human body depends on food for life and strength. Fuels drive our automobiles and airplanes and give us most of our electric power. Almost all the metal we use is extracted from ores with the aid of fuels. It is difficult also to find a manufactured article that is not in one way or another a product of fire.

The common fuels are closely similar to food in many respects. Both contain carbon compounds (see Carbon). The carbon from food is combined inside our bodies with the oxygen of the air which we take into our lungs. This process yields the energy used by our muscles and nerves. In the same way the ordinary fuels burned in furnaces, power plants, engines and chemical processes release their stored up energy by oxidation of their carbon. The available energy (heat value) of fuels is usually given in British thermal units or BTUs. One BTU is the amount of heat needed to raise the temperature of one pound of water one degree Fahrenheit. (See also Energy, Fire, Heat, Respiration.)

Primitive men burned wood to heat their caves, to cook their food and to frighten off wild animals. With the aid of wood fires they were able to fashion crude tools and weapons. In time they found they could use animal fats and vegetable oils for fuel. The first step toward the development of a better fuel, however, was the ancient discovery that charcoal gave a more intense heat than wood (see Charcoal). The Greeks used coal for smelting metal in the 4th century B.C., but coal was not employed extensively until the 18th century. Manufactured gas

FLOWERS OF THE COMMON FUCHSIA



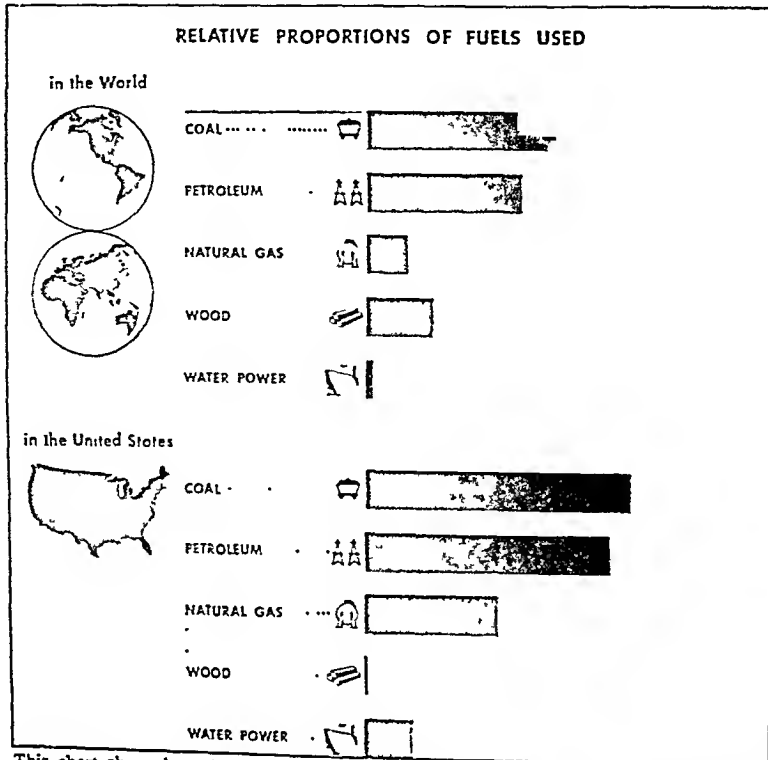
Hanging from slender stems, the delicate blossoms of the fuchsia are among the most graceful in a summer flower garden.

came into use early in the 19th century and fuels made from petroleum a half century later.

The Important Fuels

Fuels may be solids, liquids or gases. Of the solid fuels, coal is by far the most important. It furnishes nearly two thirds of the power and heat used throughout the world. In the United States it supplies less than two fifths of the total energy used. Coal is used, however, to generate about two thirds of the country's electric power (see Coal, Electric Light and Power).

Coke is a substance which is left after the gas and tar are extracted from coal. It is much used in homes and factories because it gives intense heat without smoke. Coke long ago replaced coal for smelting ores (see Coke, Iron and Steel). Peat is a natural solid fuel which is valuable in regions where no other fuel is available. It burns slowly, however, is smoky and has a low heat value (see Peat). Wood has greatly declined in importance as a fuel in modern times. In heat value it is inferior to coal and



This chart shows how the United States uses its fuels in comparison with the world in general. In the oil-rich United States petroleum is nearly as important as coal. Water power is added here because of its importance as an energy source.

it is much more expensive in communities that are far from forests. Other solid fuels are paraffin and tallow, usually burned in candles.

The principal liquid fuels are products of petroleum, such as gasoline, kerosene, and refined oils (see Petroleum). Gasoline is by far the most important petroleum product because of its use in automotive vehicles and airplanes. Kerosene is used as a tractor and stove fuel, and in communities without electric power it is burned in lamps. Light fuel oils, called *distillates*, serve as fuels for Diesel engines and home furnaces (see Diesel Engine; Heating and Ventilating). Heavy *residual* oils are used principally as steamship and locomotive fuels. Fuel oils are easy to store and handle; they can be pumped into a firebox easily; and they have more than twice the heat value of coal.

The most important gaseous fuels are natural gas from gas or petroleum wells, manufactured coal gas, and water gas (see Gas, Manufactured; Gas, Natural). Each kind is widely used for cooking and heating in city homes and for heating in many industrial processes. These fuels are extremely convenient since they can be turned on or off instantly and give no ash or smoke. Acetylene, another fuel gas, has important uses. It is employed in oxyacetylene torches and in the lighting system of buoys (see Acetylene).

Water power, of course, is not a fuel, but like the fuels, it is an important source of energy. For

this reason it is often classed with them, as in the chart on this page (see Water Power).

Fuels for Internal-Combustion Engines

For more than 100 years, steam engines provided most of the power used in industry and transportation. Fuels were burned in a boiler to make steam, and steam supplied the power. The internal-combustion engine eliminates the boilers by burning fuel in the engine itself and using pressure from the expanding hot gases to provide power (see Internal Combustion Engine). This type of engine has been particularly valuable for automobiles, trucks, and buses.

Internal combustion engines created many fuel problems, however, because they needed fuels which burned almost explosively. The Diesel engine accomplished this with cheap fuel oil by using high compression. Gasoline, though relatively expensive, proved the most practical fuel for most motor vehicles.

Wherever gasoline is expensive, constant efforts are made to use cheaper fuels for automobiles. Charcoal has been tried with considerable success in Europe. A jet of steam passing through a glowing hot mass of charcoal generates gas which burns like gasoline in the engine. The principal objection to charcoal is the bulkiness of the fuel and of the gas-generating apparatus.

Grain alcohol has many desirable properties as a fuel for internal-combustion engines and for heating. It is not so powerful as gasoline, however, and countries which use it to lower the cost of motor fuel do so by mixing alcohol with gasoline. Such mixtures have been tried in the United States, but they have no advantage over low-cost American gasoline. Alcohol, kerosene, paraffin, and gasoline are used in jet propulsion. These fuels, mixed with oxygen, burn to provide hot gases for jet and rocket engines (see Jet Propulsion; Rockets).

Fuels and National Power

The development and industrial growth of nations have been greatly affected by the possession or lack of fuels. Of these, coal and petroleum—the *fossil fuels*, as they are called—have been the most important by far. Great Britain, for example, owed the rise of its industrial power largely to abundant coal deposits. Much of the prosperity of the United States is traceable likewise to its natural wealth of coal and oil. South American countries, on the

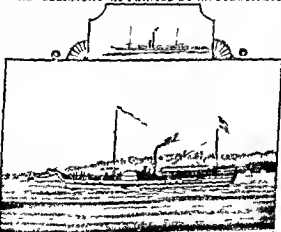
other hand, have been handicapped by difficulties in obtaining adequate fuel supplies. Switzerland overcame these same disadvantages by exploiting its great water power resources.

An interesting incident in the history of fuel was the rise of the rich whaling industry of New England in the 18th and early 19th centuries. This industry depended largely upon the use of whale oil for lamps. With the advent of kerosene, whaling almost ceased until modern industry found new uses for whale oil.

The fossil fuels of the world will last for a long time to come. Before they are exhausted, scientists predict, a new era of heat and power production will open. New fuels, such as uranium and plutonium, may be widely used in atomic-energy plants (see Atoms). More probably, however, other sources of energy will be substituted for fuels to provide the power the world needs. Water power, for example, is already widely used. Other future energy sources might be the tides and the heat of the earth and sun (see Power).

FULLER'S EARTH. Woolen cloth is *fulled* or shrunk, after it is woven. A peculiar claylike substance called fuller's earth was formerly used in this process to absorb grease. Today fuller's earth is used chiefly in refining mineral oils. Smaller quantities are employed in oil-well drillers' "mud" and in insecticides. Some is employed as a filter material and as a chemical catalyst. In the home it is sometimes used to absorb grease from clothing or wallpaper. Fuller's earth consists of very fine colloidal particles and contains calcium, magnesium, aluminum, and

THE 'CLERMONT' AS PAINTED BY AN EYEWITNESS



At the top is the 'Clermont' in 1807, its 24-horsepower engine mounted in a hull 100 feet long. The next year the boat was enlarged and altered as shown in the lower picture. The original painting is owned by the New York Historical Society.

silica. In the United States it is found principally in Florida, Georgia, and Texas.

FULTON, ROBERT (1767-1815). On a bright August day in 1807 Robert Fulton's steamboat, the *Clermont*, chugged up the Hudson River against the wind and tide. People had long been calling the craft "Fulton's folly," but as the boat moved powerfully up the river they cheered enthusiastically from the wharves of New York City. All the way to Albany and back the steamer puffed along without serious mishap, making the journey upstream in 32 hours and the return trip in 30, with the wind against it both ways. The experiment was a triumph for Fulton and won him immediate recognition and help.

The *Clermont*, however, was not the first steamboat, nor was any part of it entirely original with Fulton,

but it was the first boat so assembled and designed as to make steam navigation wholly successful. Only two weeks after its maiden trip the boat was put into regular scheduled service between New York City and Albany.

Fulton was born Nov. 14, 1765, on a small Pennsylvania farm in what is now Fulton Township. His parents were Irish. His father died when Robert was still a boy, leaving the family poor. At 17 Fulton went to Philadelphia to work for a jeweler and to study art. So well did he use his time and talents that at 21 he had \$100 to invest in a farm for his mother and sisters before going to London to study art with Benjamin West.

The lively-minded youth who had saved \$400 and bought a farm while studying painting evidently had practical qualities. English friends encouraged him to become an engineer, and art was soon forgotten in the midst of a series of useful inventions of dredging machines, flax spinning and ropemaking devices and a substitute for canal locks.

Fulton Finds the Way to Success

In the harbor of Brest he demonstrated a torpedo-firing submarine but failed to interest Napoleon's engineers. He did interest the American minister, Robert Livingston, however, in his steamboat experiments on the Seine. As a partner of Livingston he returned to America to work out a practical steam boat. He used an engine and boiler he had purchased in England from James Watt and his partner Boulton. Some of those who pioneered in steam navigation

before Fulton were the Frenchmen Denis Papin and the Marquis de Jouffroy de Lagny; the Americans Jonathan Hulls, the Americans James Rumsey and John Fitch, and Englishmen William Symington and, somewhat later, Henry Bell. These men may have had the vision to foresee the practicability of steam navigation and to design the working principles for such vessels, but Fulton's own contribution was to make the steamboat a commercial success.

Fulton triumphed where others failed because he was tenacious and shrewd and had great personal charm that won him friends and the necessary financial backing.

In 1815 he built for the United States the first steam warship. He was never wealthy, and overwork and lawsuits about patents undermined his health. He died in New York City Feb. 24, 1815.

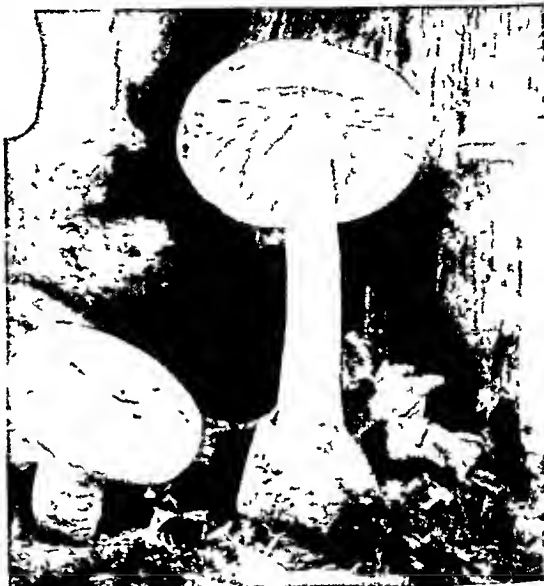
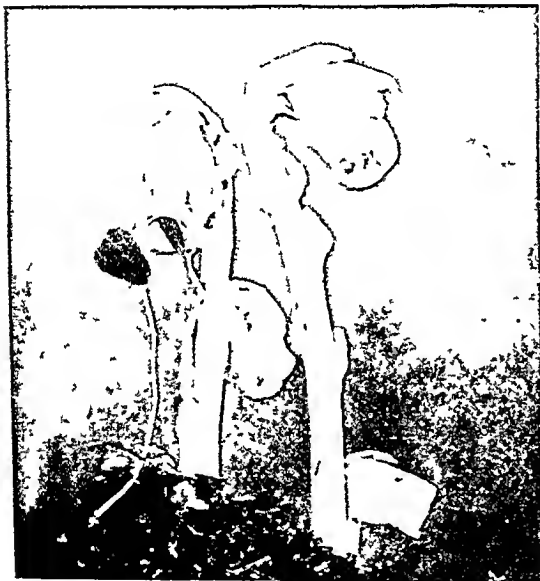
FUNGI (*fün'ji*). A large group of very simple plants, distinguished by the fact that they do not contain the green coloring matter (chlorophyll) possessed by higher plants, are known as *fungi*. This group includes all molds, mildews, rusts, smuts, yeasts, truffles, puffballs, toadstools, and mushrooms. Since they lack chlorophyll with which to manufacture their food out of raw materials, the fungi are compelled to live upon the food produced by other plants and animals. When they get their food from living creatures, fungi are called "parasites"; when they live on dead animal or vegetable matter, they are called "saprophytes." Parasitic fungi and their cousins, the

because they feared to call such terrible beings by their true name.

Their number varied, but usually they were spoken of as three: Megaera (the grimly jealous), Alecto (the unwearied persecutor), and Tisiphone (the avenger of murder). Nothing, it is said, escaped their sharp eyes, as they pursued the evil-doer with speed and fury, permitting him no rest. A famous drama of the Greek poet Aeschylus deals with their pursuit of Orestes, son of Agamemnon, for the slaughter of his guilty mother Clytemnestra.

FURNACE. The type of furnace with which you are probably most familiar is that which heats the air or

THE "GHOST FLOWER" AND THE "DEATH CUP"



The plant on the right is the deadly *Amanita* or "Death Cup," one of the most poisonous members of fungus society. On the left is that strange plant called Indian Pipe or "Ghost Flower," which is often found growing in moist dark northern forests. While it is not classed as a true fungus, it looks and behaves very much like one, for it has no green coloring matter and gets its nourishment from the roots of other plants and from decaying vegetable mold.

bacteria (called fission-fungi), do much harm, causing diseases in men, animals, and plants. The saprophytes, however, are valuable scavengers.

Fungi range in size from the tiniest molds to the huge toadstools. Many varieties such as the lichens are eaten by wild animals. Some, like mushrooms and truffles, are highly prized delicacies for human food. Certain others are used for making drugs and dyes. Yeasts are among the most useful of all fungi.

Fungi are divided into three groups: *Phycomycetes*, such as black mold, downy mildews; *Ascomycetes*, such as mildews, truffles, cup-fungi, yeasts; *Basidiomycetes*, or rusts, smuts, mushrooms, toadstools, and puffballs.

FURIES. These avenging deities of Greek and Roman mythology were daughters of Night, or according to another myth they sprang from the blood of the mutilated Uranus when he was slain by his son Saturn or Cronos. The Greeks called them *Erinyes*, the "angry ones." They also called them *Eumenides*, the "well-minded" goddesses, probably

water or generates the steam by which houses and public buildings are warmed (see Heating and Ventilating). But there are also various types of furnace used in manufactures. These may be classified as furnaces in which the fire and the material to be heated are brought into contact—as in the blacksmith's forge, the blast furnace, and the cupola; furnaces in which the fuel is in one compartment and the substance to be heated in another—as in the reverberatory furnace used in making iron and steel; and furnaces in which the material to be heated is in a closed chamber or sealed retort heated by external flames, hot gases, or electricity—as in pot furnaces for making glass and crucible furnaces for making steel (see Glass; Iron and Steel).

Perhaps the most interesting type is the modern electric furnace, out of whose furious blasting heat have come some of the most amazing achievements of modern chemistry. With the aid of its tremendous

temperature—7 000° F. and more—platinum, chromium, tungsten, molybdenum and other refractory metals can be melted from their ores. So hot is it all fire quartz so that it can be blown or molded like glass to make retorts and other laboratory aids. These can be heated and then plunged into ice water without breaking. The heat of an electric furnace can change carbon from coal into graphite. It can fuse carbon and silicon into carborundum—one of the hardest substances known—for grinding and polishing metal. It can force carbon and lime to unite as calcium carbide for use in manufacturing acetylene gas. From quartzite rocks it can force out phosphorus used in matches and matches. Most alloy steels for modern manufacturing are forged in electric furnaces. These furnaces are being used more and more to produce iron and steel in place of the Bessemer and open hearth processes.

Every type of electric furnace has a crucible of some nonconducting heat-resisting material. The arc type gets heat by passing a powerful current between electrodes or from electrodes to the substance being treated. In another type the crucible is surrounded by rods or wires which are heated by a current. Chrome nickel can take current without melting for a temperature of 1 000° C. For higher temperatures platinum or molybdenum is required. Usually a hydrogen atmosphere is supplied to avoid oxidation.

Most wonderful perhaps of all uses of the electric furnace is fixation of atmospheric nitrogen. In enormous furnaces electric arcs are drawn out into great disks or spirals of flame. These unite nitrogen and oxygen from the air as nitric oxide. This is easily turned into nitric acid or nitrates for fertilizers and explosives.

FURNITURE Making—Both CRAFT and INDUSTRY

FURNITURE Primitive wandering man slept on the ground and sat wherever it was convenient—on the ground, a stone or a fallen log. But man's love of home and his desire for comfort have increased steadily through the ages. In the United States today people spend more money on furniture in their homes than on anything else except food and clothing. For furniture alone they pay about 2½ billion dollars a year.

The furniture industry in the United States has about 5 000 factories and employs close to 270 000 people. The industry has several branches. One makes household furniture. Others produce furniture for of-

fices, public buildings and restaurants and furniture for professional uses.

Household furniture includes living room, dining room and bedroom furniture, porch and yard furniture, kitchen furniture and cabinets for radios, phonographs and television sets. Although household furniture is usually designed for the home, it may actually be bought for a home, a hotel, a college dormitory or other institution. It may even be bought for special use in a public building like the chairs shown in the picture below.

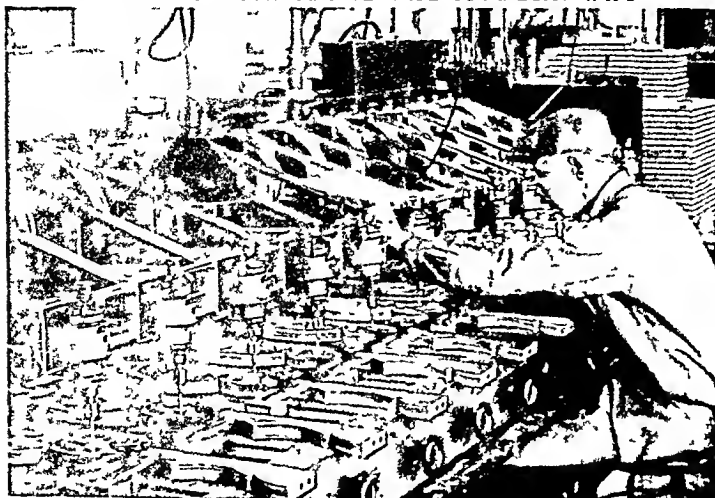
Public building furniture, on the other hand, includes standard chairs, desks and tables for schools.

MAKING CHAIRS FOR THE NATION'S HIGHEST COURT



The design of these stately leather-covered chairs was the work of the United States Supreme Court. The frames of such chairs must be of very hard wood, such as oak, and may be of any shape. The upholstery is made of leather and is finished with gold leaf. The chairs are made in the workshop of the United States Supreme Court in Washington, D. C.

CARVING FURNITURE THE MODERN WAY



Here one man operating one machine is carving 12 furniture parts simultaneously. The 12 knives work in unison, controlled by the movements of a metal finger as it follows the design on a metal pattern.

and libraries, pews for churches, and seats for theaters and assembly halls. "Professional furniture" includes beds and tables designed especially for hospitals, work tables designed for laboratories, and furniture for beauty shops and barber shops.

About 90 per cent of the furniture factories in the United States, employing 85 per cent of the workers, make household furniture. By comparison, the other branches of the industry are small and highly specialized. They are localized within a few states. New York, Ohio, Michigan, and Illinois lead in the production of office furniture. Michigan, Wisconsin, Illinois, and New York lead in making public-building furniture and furniture for professional uses.

CARVING BY HAND—AN AGE-OLD ART



Electric saws in a modern factory cut this chair back into a Chippendale design. But a 20th-century craftsman is carving the trimming exactly as one of Thomas Chippendale's own craftsmen would have done in the 18th century.

Household Furniture—a Craft Product

ABOUT 85 per cent of the household furniture produced in the United States

is made of wood or is upholstered on a wood frame. The manufacturing of such furniture is still a craft. Power-driven machines shape and joint the parts and save manual labor in the finishing processes. But operation of the machines requires skilled workers. Assembling and fitting the parts involves handwork in which skill and care are more important than speed. Conveyers move through modern furniture factories in assembly-line style. The movement is slow, however, compared with the speed and precision of most completely mechanized production lines.

The craftsmanship aspect is most obvious in the making of fine furniture. Such furniture may have hand carving, hand-done inlay, or hand-painted decoration. Even the most thoroughly "modern" furniture, which takes full advantage of machine methods and modern materials, depends for its beauty on craftsmanship in design, construction, and finish.

Most Furniture Factories Are Small

The combination of manual skills with machine techniques tends to keep furniture plants small. Another factor is equally important. Household furniture is not a standardized product. There are innumerable variations in homes to be furnished and in the tastes of their owners. Factories in the United States produce an estimated 300,000 different models of household furniture in a single year. This

means that each production line turns out only 200 or 300 units before being stopped and reset for a different model. With production on such a small scale, a small factory can be as efficient as a large one.

Among all the factories in the United States which make household furniture, only one has more than 2,500 employees. This factory makes bedsprings and mattresses, which are highly standardized furniture parts rather than furniture. When plants making household furniture are grouped according to size, about 40 per cent have less than 10 employees. However, factories with 100 to 250 employees are the most important group, both in total number of workers and in value added to raw materials by manufacturing processes. The average factory has about 45 employees.

These figures refer to furniture factories not to companies owning factories. Some large companies have several factories. Usually these are in different states to be near different markets.

The Furniture Industry Is Scattered

More than 35 states produce household furniture in important quantities. With value added by manufacture as the standard, the north-central states make about 36 per cent of the nation's furniture, the eastern states 30 per cent, northeastern states 23 per cent, and western states 9 per cent. Of the ten states which lead in most annual listings, five are in the north-central area (Illinois, Indiana, Michigan, Ohio, Wisconsin). Two are in the South (North Carolina, Virginia), two in the northeast (New York, Pennsylvania), and one in the West (California).

The history of the furniture industry in America helps to explain this geographic pattern. Wealthy merchants and traders in the northern colonies bought most of their furniture from cabinetmakers who had set up shops in which to make furniture on order. Plantation owners of the South, on the other hand, preferred to import fine furniture from England or to install cabinetmakers in their homes to make sets of furniture. For this reason, cabinetmaking flourished as a business in the North long before it did in the South. The early centers were Boston, Newport, R.I., New York City, and Philadelphia.

The machine age came to the furniture industry in the 1820's with the invention of power-driven machines for woodworking. The first factories were built in areas where furniture making was already an old industry. Firms which are still in existence built plants in Philadelphia in 1825 and in Gardner, Mass., in 1828. The industry grew slowly at first. The new machines were generally regarded as improved tools rather than as a means of mass production.

In the interval before the Civil War sawmills sprang up near the hardwood forests of New England, the north-central area, and the South. New markets developed as the population grew and expanded west-

ward. Transportation improved at first with the growth of river traffic and then with the coming of the railroads.

Furniture Making Goes West

After the Civil War there was a tremendous increase in furniture manufacturing. Quantity production, even though it was on a small scale compared to that in many modern industries, had a bad effect at first. Designs were usually poor and

FURNITURE ON THE ASSEMBLY LINE



The workman above has stopped a moment to let another see that he can do the work of a man. He is a man of many parts. When he releases a bolt, the desk will move on.

construction often inferior. Grand Rapids, near the great forests of Michigan, forged ahead as a leader of the industry during this period. It began to fall back as a producer in the 1920's when the Michigan timberlands ran out. Today the Grand Rapids area is known for its manufacture of fine furniture rather than for quantity production.

The South began to take full advantage of its timberlands as the forests of the North were exhausted. Southerners built comparatively large factories and established the most up-to-date machine techniques. As a rule they made very cheap furniture. This found a ready local market. The market expanded during the depression years of the 1930's and the southern factories flourished. In time some of them turned to making well-designed furniture of good quality.

Furniture making grew rapidly in the far West after the late 1930's. Factories in California, Oregon, and Washington were known for their size and for their highly mechanized production lines. In addition, some of them had considerable influence on furniture designing.

Marketing Furniture
Since the furniture industry is scattered and its product is bulky, heavy and expensive, selling pre-

MACHINE AGE CONSTRUCTION AND DESIGN



These chairs designed by Charles Eames would be impossible without modern machine techniques for making and molding plywood. Electronically glued rubber shock absorbers in the mountings are as supple as resins. The table as modern as the chairs was designed by Isamu Noguchi.

A STOP IN THE SPRAY BOOTH



Electrically operated airbrushes and air guns have banished the varnish brush from furniture factories. The workmen shown above are spraying fast-drying lacquer onto tables with air guns.

sents special problems. Salesmen cannot carry samples from factories to retail stores. Selling from catalogs is not altogether satisfactory. Buyers for retail stores want to see and feel furniture before they buy it. They want to test the comfort of chairs and davenport, to see the finish of wood and the color of upholstery, and to open and close drawers. Furniture manufacturers, for their part, cannot afford to make quantities of furniture in styles which they may not be able to sell.

To meet these problems, the industry has established furniture markets. The market places consist of one or more buildings in which manufacturers rent space and display samples of their furniture. Buyers from retail stores flock to the markets. They can examine the displays of many manufacturers at one visit. They may place orders immediately or later on, as they need new stock. This system enables manufacturers to make furniture chiefly on order. It enables buyers to see and examine before they buy.

Seven Cities Have Large Furniture Markets

New York City, Chicago, Los Angeles, San Francisco, Grand Rapids, Mich., High Point, N. C., and Jamestown, N. Y., have permanent furniture markets. They also hold seasonal markets where manufacturers can call attention to new lines. Firms which make 75 to 80 per cent of the nation's furniture display their wares at these markets.

As a rule the big markets combine furniture and home furnishings. Some of the seasonal markets are enormous. Forty thousand or more buyers throng Chicago during the summer and winter markets. For

three to ten days they tramp through five miles of displays on 16 floors of the American Furniture Mart and through several vast floors of the Merchandise Mart.

Furniture on the Production Line

Wood comes to the furniture factory as veneer or as rough lumber from a sawmill. Veneer is a manufactured product, ready for use (see Veneer; Plywood). Rough lumber, on the other hand, is unseasoned. Its millions of tiny cells still contain much of the moisture they absorbed when the wood was a growing tree. The cell walls will dry naturally in time as the wood is exposed to air. They will shrink as they dry and the wood will become smaller.

If drying is not complete before the piece is made into furniture, it will continue afterward. Warping, shrinking, and badly fitting parts will be the result. To force the drying, or to season the wood, as it is called, is therefore the first step in handling rough lumber. Drying is carried out in drying rooms or kilns, where circulating air, regulated as to heat and humidity, seasons the wood within a few days.

Preparation of a production line begins with the designing of a single piece or a set of furniture. The designer is an artist.

A design or engineering department translates his designs into drawings for individual parts.

A production line begins when conveyers carry seasoned lumber from a kiln to a near-by section of the factory for rough milling. Here an automatic cutter saws boards to specified lengths and a planer smooths the surfaces. Ripsaw operators cut the pieces lengthwise to remove faulty wood. Some pieces are now ready to be shaped into chair legs and other small parts. Others have to be glued together to make pieces large enough for table tops, chair seats, and so on. The glueing is done by machine, and the boards then go into a press. Planing follows. If veneer is specified it is added in the glueing room.

In a machine room, some of the workers cut the roughly prepared pieces into specified shapes, using band saws and other cutting machines. Other workers do machine carving, prepare mortise-and-tenon and dowel joints, and carry out other special processes.

Assembling is done chiefly by hand. The workmen have the help of electric drivers and drills as well as air-driven clamps. After assembling, the pieces may be sprayed with a sealer coat and held for finishing until orders for types of finish come through from the sales department.

When a piece of furniture is put on the conveyer line for finishing, it usually stays there until the final rubbing. It visits various spray booths and drying ovens. The type of coatings applied depends, of course, on the finish desired. Somewhere along the route, good furniture usually receives a hand sanding and final hand rubbing.

What to Watch for in Buying Furniture

THE CHOICE of wood is one of the most important considerations in buying furniture. Walnut is ideal. It is hard and strong, yet only moderately heavy. It has a fine grain and color and takes a beautiful finish. It carves well. Mahogany and other tropical hardwoods have fine graining and texture. Their lustrous satin finish is well known. These woods have the reputation of making the finest furniture. All, however, are expensive. Certain domestic woods, including cherry, elm and ash, are equally strong and are good looking if not so fine. When expense has to be considered, they are an excellent choice.

In buying upholstered furniture it is wise to make sure what kind of wood is in the frame. Hard maple, ash and birch are especially suitable. They are hard, strong and durable. If the wood has been well seasoned, the frame will hold its shape despite wear and tear. These woods take glue well. They can be finished to look like walnut or mahogany, so that the upholstered piece will match other pieces in a room.

Strong Joints for Sturdy Furniture

The strength of furniture depends to a great extent on the way it is put together at the joints or corners. Two types of joints are characteristic of good furniture: the mortise and tenon and the dowel. These are illustrated in the drawings at the right. A dowel, it should be noted, is a wooden peg, preferably with spiral and horizontal grooves to hold glue.

It is usually impossible by looking at the joint of a finished piece of furniture to be sure whether it is of dowel or of mortise and tenon construction. However, if neither of these types has been used, telltale screws or nails may betray the fact. In any case, a furniture salesman should be both willing and able to tell what construction has been used. If he does not know, he can find out from the store's buyer.

In dowel and mortise-and-tenon construction, a corner block should reinforce the joint as shown in the drawings. The grain of

the wood in this block should run diagonally across the joint. All parts of the joint are glued. In addition, two screws secure the corner blocks.

Smoothly Sliding Drawers Are Important

To examine the drawers in a bureau, desk or other cabinet piece, it is necessary to remove one from the case. Well-made drawers are dovetailed at all four corners. Dovetailing is illustrated in the drawings below. Fine furniture may have metal rollers as drawer guides. These allow easy pulling out and pushing in. Wooden guides are less expensive and are satisfactory if they are smoothly finished.

Drawers should fit closely but not so tightly that they jam or stick. The bottoms should be substantial. Three-ply laminated construction, with a total thickness of one-quarter inch, is satisfactory. A panel between drawers, preferably three-sixteenths of an inch or more thick, provides dustproof construction.

A Finished Interior Means Good Furniture

No one expects furniture to look as finished on the inside as it does on the outside. Nevertheless, the more nearly the interior and underpart resemble the exterior, the better the furniture. Finishes are for protection as well as for beauty. All wood parts, whether or not they ordinarily show, should be sanded

and then shellacked or otherwise finished to resist dampness and wear and tear.

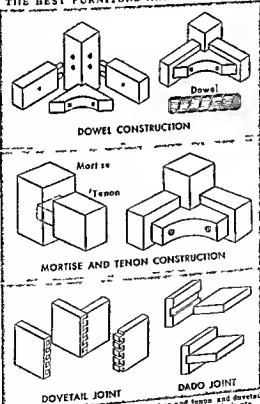
Smears of glue near joints are a warning of careless workmanship. If they flake when scraped with a fingernail, they indicate, in addition, use of inferior glue. The presence of nail heads is another warning. Good furniture contains few or no nails.

How Many Springs?

A store may have cross sections of upholstered furniture to show spring construction. Otherwise, the sales clerk will provide information.

Large double cone springs give the greatest resilience. A chair of ordinary size and of good quality has 9 to 12 of these. An extra large chair should have 16 or more. The springs should be close together. In furniture of the best quality, each spring is tied by hand to the frame eight times with strong hem twine.

THE BEST FURNITURE HAS THESE JOINTS



The text explains the use of dowel, mortise and tenon and dovetail construction. Shelves are fitted into cabinets with dovetail joints.

Furniture's Heritage from the Past

THE beginnings of furniture as we know it today go back to ancient Egypt. The Egyptians had stools, chairs, tables, chests, and beds. These can be seen in museums today. The Egyptians put such everyday objects into their tombs to be used in the future life. They painted scenes of daily life on the walls of their tombs. Some of these were indoor scenes and showed furniture in use. Sealed in the great tombs, examples of both the real furniture and the pictured furniture were preserved through the centuries. (See also Egypt, Ancient, opening section and section "Everyday Life in Ancient Egypt.")

Many Egyptian chairs were folding seats, like the one shown in the bottom picture. The seat was usually leather. Others, like the one in the top picture, were throne chairs. In these a tall back merged gracefully into the seat piece. There were also wooden armchairs. Some Egyptian beds were like the folding seats, only longer. Others consisted of a rectangular wood frame supporting leather webbing. Some royal beds were elaborately carved.

Egyptians often carved the legs and feet of furniture to represent the legs and feet of animals. This type of decoration has persisted through the ages (see Interior Decoration). Painting was a favorite way to finish or to decorate furniture. Many chairs were painted white. Chests often had geometric designs painted in bright colors. The Egyptians used both plain veneer and inlay. The inlay might be carried out in gold, mother-of-pearl, ivory, or even precious stones.

A fact which seems strange today is that the Egyptians did not use much of their finest furniture at all—not even before having it put in their tombs. They had it made especially for their tombs. This was true not only of wealthy people but of all who could afford to own furniture. They felt that their equipment for the future life was more important than their comfort in this life. Some of their tomb furniture came to them as gifts. If a wealthy man wanted to please a friend, he might have a tomb chair made for him. The chair was sure to be beautifully designed.

It might be elaborately decorated, in gold leaf or some other rich material.

Knowledge of the furniture of ancient Greece comes chiefly through sculpture and vase paintings. These

tell us that the early Greeks had beds, chairs, couches, chests, and tables. The designs were basically those of ancient Egypt but had a charm and beauty which were typically Greek.

Chairs had gracefully curved legs and backs. Some of the designs suggest that they were carried out in bronze rather than in wood. There were reclining chairs like elongated thrones. The typical tables were low and had three legs. People ate from these as they reclined on beds or couches. After the meal a servant could carry the tables out of the room or tuck them out of sight under the couches.

The earliest Roman furniture was very simple. It had severe lines and little decoration. After the Romans had contact with the Greeks, they adopted the basic Egyptian designs as interpreted by the Greeks, but gave them greater solidity. Furniture became more delicate and more highly decorated during the Roman Empire. Pillows made of rich textiles added to the general effect of luxury and comfort.

Roman beds looked much like modern day beds. A cushion at one end served as a pillow for sleeping. It became an armrest when the bed was being used as a couch for dining.

One type of Roman chair had a square seat and legs shaped like an "X". It looked something like a folding campstool with a back. But it was handsomely made and was inlaid with ivory. This was the *curule*, sat upon only by the highest officials. Another type was a double chair, or *settee*, ancestor of the sofa. The head of the house had a throne-like chair called a *solium*. Roman tables had great variety in sizes and shapes. Many of them rested on heavy carved pedestals. (For pictures, see Roman History.)

Furniture in the Middle Ages

The serf of the Middle Ages was lucky if he had a bench, a table, and a bed. The table was usually a

FURNITURE OF ANCIENT EGYPT



In the top picture, from a tomb painting, a queen of ancient Egypt named Nofretete, mother-in-law of King Tutankhamen, is playing checkers. The bottom picture shows a typical folding chair. The seat was leather.

board set on trestles. From this fact arose the expression 'set the table.' The bed was merely a long bench pushed against the wall.

The furniture even of the barons was simple. During most of the Middle Ages warfare kept the barons moving from castle to castle. They carried chests and coffers with them to hold their clothing, bedding and valuables. These served as seats and beds for attendants. The barons themselves and their ladies had folding chairs. Their beds were chiefly piles of cushions and coverlets.

Furniture developed as baronial life became more settled. Chests were set on legs. Chairs, settles, benches, and wooden beds with curtains appeared. A canopy above a chair or settle turned it into a throne. Cupboards and cabinets came into use in the 15th century. Tables were scarce. The baron like his servant ate from boards set on trestles.

Furniture throughout the Middle Ages was chiefly of unpolished oak. Some of it was carved. Favorite motifs were flowers, leaves, and grotesque animal and human forms. Under the influence of Gothic architecture both the basic design and the ornamentation took on an architectural look. The tableboard in the picture below illustrates this trend. The panels are

carved in a design of pointed arches and the sideboard has a kind of roof.

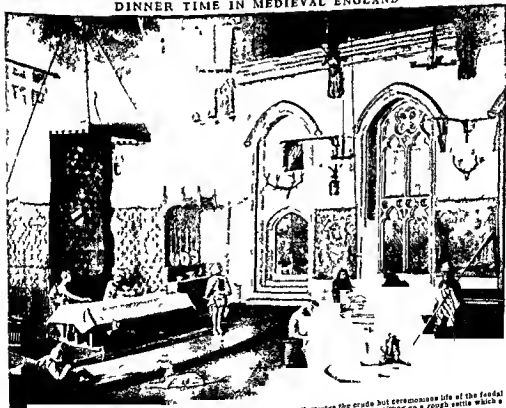
In England the late medieval or Gothic period merged into the Tudor period. In Europe the Renaissance brought a number of styles which stemmed from the revival of classic forms and decorations in Italy. The earliest European style which had an important influence on the furniture of today was that established by Louis XIV in France (see Interior Decoration).

Furniture in the American Colonies

Carpenters, sawyers and joiners were among the early settlers in all the colonies. They helped build crude beds, benches and tables for the colonists' first homes. As colonial life developed, trained cabinetmakers came to the colonies. Some of these men traveled from one settlement to another, stopping wherever they found work. They usually did the entire job of furniture making, from felling trees to finishing. Some of the more skillful craftsmen settled in towns and set up shops.

These early furniture makers followed as best they could the current styles of their homelands. Since most of the early colonists were English, most Early American furniture is of Jacobean design (see Amer-

DINNER TIME IN MEDIEVAL ENGLAND



Here is a reproduction of the great hall in Peasmarsh Castle, England. It illustrates the crude but ceremonious life of the feudal barons. Vassals are cooking the dinner in the fireplace at the right. The baron and his wife are sitting on a rough settle which a canopy has converted into a throne. This reproduction is in the Metropolitan Museum of Art, New York City.

A CYCLE IN AMERICAN FURNITURE



The top picture shows the Early American kitchen at Kenmore, in Fredericksburg, Va. The handmade furniture is simple, utilitarian, and attractive in its simplicity. The middle picture, a Victorian parlor in the Metropolitan Museum of Art, New York City, illustrates the fussiness made possible by machine carving. The bottom picture shows a modern return to simplicity with better use of machine methods.

ican Colonies, sections on Southern, Middle, and New England Colonies, Interior Decoration).

Furniture and the Machine

The invention of the power-driven lathe and saw made it possible to cut many identical furniture parts quickly and easily. This was the source of "mass production" in furniture making.

Some of the first attempts at mass production resulted in sound, attractive furniture. Hitchcock chairs are an example. These chairs were made from 1820 to 1850 in Connecticut, in factories owned by Lambert Hitchcock. They are collector's items today. The simple slat backs were made in a variety of pleasing shapes. The seats were rush. The chairs were painted to look like rosewood and were decorated with fruit or flower designs done in gold.

The development of power-driven knives for carving and lathes for turning had a bad effect on furniture design. Furniture makers wanted to use the new machines to the limit of their capacity. The result was a maze of carving and turning—the "gingerbread" decoration of the Victorian era.

A reaction against fussiness and obvious machine production took place in England in the 1860's (see Morris, William). "Mission furniture," popular from 1900 to 1910, was a manifestation of this arts-and-crafts movement in the United States. Its makers copied furniture made in early Spanish missions of the Southwest. They tried to make machine-produced furniture look handmade.

In another reaction, "modern" designers abandoned the traditional designs of handmade furniture. Some created *functional* furniture—simple, utilitarian, undecorated forms. Others, trying to express the machine origin of furniture, used strange shapes which had little relation to utility or beauty.

The tendency today is to make full use of machine techniques, without overusing them, as the Victorians did, and without trying to express the machine itself. The emphasis in design is on utility, comfort, and beauty in shape.

The FUR TRADE—A HISTORY of HEROES and ROGUES



From far in the frozen North come many furs for the silky fox skins, true seal, and white winter anise. Here a white trader bargains with Eskimos for their prime pelts. The Eskimo at the left is Nagook who played the central rôle in a famous documentary film. Nagook of the North made by Robert Fleisher in 1920-22. Behind the trader sits Nagook's wife Nyla, holding her child close inside her own fur garment. Behind the group hangs a beautiful and costly array of fox skins.

FURS AND FUR TRADE Long years before the first settlers and farmers migrated westward bold white men were hunting and trapping in the unmapped mountains, forests and streams of North America. They were seeking furs worth a fortune in Europe. There for centuries wealthy men and women had worn furs made up in costly robes, coats and hats, and as trimming on other garments.

Of course, all the early settlers in America whether they came to seek fortune, religious freedom, escape from the law, or for mere adventure, had soon come to depend on furs for winter garments and had learned much from the Indians about how to prepare them. It was not the simple farmers of New England who originated the great fur trade but the woodsmen of New France.

As New France spread westward from Quebec to the Great Lakes, adventure-loving Frenchmen quick to learn and adopt Indian ways, pushed out more and more boldly into the wilderness in search of skins. In New France furs were the chief export and the only product worth taxing. The French king saw his opportunity for gathering revenue and forbade any one to trap without a license, though many did so and bought immunity with their wealth. The trapper also had to pay the value of one fourth his furs as crown tax to the king, who regarded New France as a purse of gold.

Radisson, Bold Adventurer

Some two score years after Henry Hudson was betrayed by the mutineers in icy unknown Hudson Bay, there lived in the town of Three Rivers in New France a thin, dark boy who looked like an Indian.

His name was Pierre Esprit de Radisson. He went out to hunt one May night in 1652 when he was 15 or 16 years old. The Indians slipped up, killed his three companions among them his sister's husband, and took him captive. He was their prisoner for two years and was once cruelly tortured when he tried to escape.

At last a boy no longer he fled to the Dutch settlement at Albany, N. Y. and got back home. He had the steely muscles of an Indian and so Indian's courage and endurance. He knew Indian ways and speech, Indian skill at living in the dangers and privations of the wilderness. His early adventures had given him perfect training for the remarkable rôle he was to play in the history of the wild, unknown New World.

Radisson Finds a Partner

When he got back to Three Rivers he found his widowed sister married to Medard Chouart des Groseilliers a man as daring and clever as Radisson in woodcraft. In April 1659 some Algonquins were about to return home from Ottawa with 30 Frenchmen and two Jesuits who wished to explore the unknown land of the forests. Radisson and Groseilliers applied to the French governor at Quebec for a license to trap in the *Pays d'en Haut*, the Up Country, as all the land west of the Great Lakes was vaguely called. Their request was refused. But the merchants of Three Rivers knew that these two lean young men could speak to the Huron, Algonquian, and Erie Indians in their own tongues and had no fear of their arrows and guns. They secretly supplied the pair of adventurers with goods for trade. The two set out with the party of Algonquins and whites, were attacked

LA VERENDRYE EXPLORES THE UPPER MISSOURI



Friend of the Mandans, explorer of the upper Missouri River, Pierre Gaultier de Varennes, Sieur de la Vérendrye, was one of the heroic French-Canadians who founded trading posts for the Hudson's Bay Company, and thus opened the west to settlers.

by the Iroquois, and all the white men but Radisson and Groseilliers were frightened back. Onward these two pushed. With a tin mirror or a few beads they hired Indian guides. With guns and bullets and finery they bought furs and more furs. While Radisson explored, Groseilliers stayed in camp and traded, and startled the Indians with his big black beard, the like of which they had never seen, they said, except on the Spaniards down the great Mississippi River.

Talk of the Great River fired Radisson. On he went across Wisconsin and Minnesota until he reached the Mississippi. He was the first white man to see its northern part and to meet the prairie tribes—the Sioux, Illinois, and Missouri Indians, who conversed in the sign language. Not only did Radisson make this enormously difficult journey to the Mississippi, but he also went overland, through woods and over prairies, from Lake Superior to Hudson Bay. On James Bay, at the very bottom of Hudson Bay, he found "old forts all battered with bullets," which may have been the first forts set up there by Henry Hudson during the bitter winter which caused his crew to mutiny (see Hudson, Henry).

After all this wandering in the wilds, among savages from whom most white men would have fled in terror, Radisson and Groseilliers

came dashing back to Three Rivers with the largest flotilla of Indian canoes ever seen on the St. Lawrence. In them was a fabulous fortune in furs, some \$115,000 worth, a great sum in those days. New France was on the verge of bankruptcy. The two explorers had the sanction of neither church nor governor in their expedition. Therefore the monopolists of Quebec pounced on this furry treasure greedily and deprived the pair of most of their wealth. Only \$20,000 was left to Radisson and Groseilliers.

They Call on the English King

It is easy to imagine their rage. After vain appeals to the French court, they tried to recoup their fortunes in various ways, and shortly involved themselves in a lawsuit in Boston over the loss of a hired vessel. In Boston, however, they met Sir George Carteret (Cartwright), one of the English commissioners sent to take over the Dutch colonies for England. Possessing an Englishman's keenness for business, he quickly saw the riches to be gained through these valiant explorers. He invited them to go back to England with him and tell their tale to King Charles II of England. They went, were taken prisoners off their ship by the Dutch, and had just time to drop into the sea all Radisson's precious notes of his travels. They could offer King Charles at Oxford only a word-of-mouth, unprovable, wild story of the opportunities beyond the sea.

The fascinating, almost incredible tale of the two Frenchmen appealed mightily to both King Charles and his cousin, Prince Rupert, Duke of Bavaria, who had valiantly fought for King Charles I, and shared the exile in France of Charles II. Both could talk in French to the two adventurers, and made much of them at court festivals. They became known to the English as Mr. Radisson and Mr. Gooseberry, since the name Groseilliers means in French gooseberry bushes.

Though Charles II and Prince Rupert were short of funds, their courtier friends, delighted with the

WHY STRONG BACKS WERE NEEDED IN THE FUR TRADE



Even the voyageurs stopped their gay French songs when it was necessary to take packs and canoes on the back and "portage." This scene shows the Great Dog portage on the Red River.

adventure of fur trading, organized. The Governor and Company of Adventurers of England trading into Hudson's Bay. "One of the adventurers was a Lady Margaret Drax. The 'adventurers' bought goods to be used in bartering for furs. By 1668 when the two Frenchmen had been in London nearly three years, the king had obtained two rickety ships, the *Eaglet* and the *Nonsuch*, for the trip to Hudson Bay. Radisson's ship the *Eaglet* was driven back but Groseilliers returned to the "old fort all battered with bullets" and set up a "Fort Charles" for trade on a stream he called the Rupert River.

When Groseilliers returned in the autumn of 1669, his ship was loaded with soft, deep, silky furs. The Gentlemen Adventurers must have celebrated his arrival with toasts to Mr. Gooseberry, and a feast of "roasted pullets" at the Tun Tavern, their favorite rendezvous. The furs meant huge profits for the company at this time when English royalty gloried in ermine for their robes, and rich men desired lynx skins for their bed covering and beaver for their hats. No elegant costume was complete without a beaver hat, made by shearing the hair off the beaver fur and felting it.

The Gentlemen Adventurers at once applied for a royal charter of exclusive monopoly of the regions draining into Hudson Bay—a sweeping preposterous charter granted them in May 1670 (see Hudson's Bay Company). The company had power to govern, to exclude or admit settlers, to make war.

Through all its spectacular career it retained the traits of being "gentlemanly" and "adventurous" which its delightful name implied. The governor at each fort was a little autocrat with absolute power. He could order a lazy or treacherous employee flogged, but if a man lost his toe by frost while snow shoeing through the woods, he would be awarded "four pounds smart money." Gifts large and small were showered on those who did the company favors: gifts of "catt on beaver skin counterpanes" for bed covers, "pairs of beaver stockings for ye King," or "gold in a faire embroidered purse," or, to one, "a perwig to keep him loyal."

A Picturesque Scene in the Wilds

When the company was first organized, the scene when furs were bartered was a bright and barbarous display. The white traders, dressed in regimental uniform, with brilliant velvet silk lined capes flying, marched out with swords a-jingle and bugles and drums playing quick music. They met Indian chiefs in robes of painted buckskin wearing strands of precious wampum, or braves with head-dress of eagle

quills streaming quite to the ground, one quill for every enemy conquered. The Indian fell to the ground and presented the whites with the costly furs of his winter's trapping. The white man smoked the peace pipe, gave thanks to the Sun for meeting the great Indian chiefs, and gave them guns as a gift. They did not speak of buying and selling, but only of gifts.

Into the ships which the company had bought or leased went the furs into the ships whose sailing orders were signed. A God speede a good wind a

faire saile y'r loving friends. When the furs reached the loving friends in London they were sold at a bustling public auction. The auctioneer would stick pins in a lighted candle and hear the bidders would shout in gusts of oratory and bidding until the candle burnt to each pin when bids closed.

Beaver Skins Become Money

In time, however, as the trade grew, gift giving was abandoned and the beaver skin became the unit of

measure. A beaver skin was 'coin of the realm' until as late as 1820. For one beaver skin the trapper could buy one half pound of beads, a kettle, a pound of shot, five pounds of sugar, a pound of tobacco, two awls, twelve buttons, twenty fish hooks, twenty flints, or eight bells. For six skins he could get a blanket, for twelve skins a gun for four skins a pistol.

On the thrones of France and England in these early days of the Hudson's Bay Company were two of the wisest, shiftest monarchs in history, Louis XIV and Charles II. Openly friendly, the two nations were secretly trying to outwit each other, particularly in the New World. Poor Radisson honest and brave himself, was buffeted between these two royal rascals, sometimes going over to the French in rage at English deceptions, sometimes patching it up with the English in the hope that the Hudson's Bay Company would give him justice. They never did, and their greedy behavior toward Radisson, the courageous explorer who had made possible all their wealth, is the one great blot on the record of these 'gentlemanly' adventurers, usually so just and honorable men.

It is not possible to follow in brief space all the coming which went on between the French and English for traders while France and England kept up the war for mastery in America. The fur struggle and the land struggle continued between the two nations until 1763. One might think that, with Canada in English hands, the troubles of the Hudson's Bay Company were over. But the most bitter and bloody fighting of its history lay ahead as new rivals appeared on the scene.

Roaming the wild "Up Country" were some 2,000

A HUDSON'S BAY POST IN MINNESOTA



In the old days of the fur trade northern Minnesota was a trapper's paradise. This old trading post of the Hudson's Bay Company, in Itasca Park, Minnesota, still stands.

coureurs de bois and *voyageurs* of the old French fur trade. The former, "wood-runners," were men who had learned Indian ways and trails, and set out with canoes full of goods to trade for furs. The latter, "travelers," were experts in knowledge of waterways, shooting the rapids, portaging heavy loads. They hired out their skill to merchants or to anyone traveling in the wilderness. In later years the two terms were used almost interchangeably, as the *coureurs* ceased to trade on their own account and served chiefly as *voyageurs*. These men, who knew every stick and stone from Quebec to the Rockies, were left at a loose end when Canada came under British rule. As they drifted back to Quebec and Montreal, they found canny Scottish merchants, ready with fur trading proposals and stocks of goods, and now unhampered by the necessity of getting a license from a French governor. There were the McGillivrays and McTavishes and Mackenzies and MacLeods and MacGregors, small merchants or peddlers, who in 20 years built up vast fortunes. The Scotsmen pooled their interests and in 1783 organized the North West Company, known as "the Nor'westers." Many of them were unscrupulous and cruel.

The Fierce Struggle for Furs

Among the intrepid leaders of the Nor'westers were such men as Sir Alexander Mackenzie, the discoverer of the Mackenzie River; Simon Fraser, discoverer of the Fraser River; David Thompson, who found the way down the Columbia south of what is now the Canadian border. The Nor'westers paralleled every fort built by the Hudson's Bay Company.

Then followed the most murderous, wicked era ever known in all the fur trade of North America. It lasted from about 1789 to 1821.

It was in a no-man's-land beyond the reach of law. Trappers and traders swarmed over the whole Northwest, and in vain did the Hudson's Bay Company roar that they had sole rights in their domain. They were as powerless as the king who struck at the gnat with his golden scepter.

All the traders played a game of enticing the Indian trappers from each other. The Hudson's Bay Company might have outfitted an Indian on credit during several lean years, and taught him to trap properly. A Nor'wester or a Mackinaw man would then get the Indian tipsy and buy his furs cheap, or perhaps outbid the Hudson's Bay price. Then the Gentlemen Adventurers would drop down on a Nor'wester fort and raid it for the furs which they considered had been virtually stolen. Meanwhile the people of the United States, pouring

out over the Alleghenies and Appalachians into their new western lands, necessarily began to take more active interest in the fur trade. A little, sharp, shrewd, rotund German-American, John Jacob Astor, who had begun as a "peddler" dealing in trinkets to barter for furs, plainly saw that the Hudson's Bay Company and the Nor'westers were both undergoing heavy losses in their strife. He had organized the American Fur Company, and amassed a fortune. He went up to Montreal, shortly before the War of 1812, and sought to ally the Nor'westers with his own company, and put an end to rivalry with the Hudson's Bay Company. The haughty Nor'westers laughed at him. But there were a number of dissatisfied Nor'westers whom he engaged for his new Pacific Fur Company, which was to send ships around the Horn and up to Alaska, and plant a powerful fort, Astoria, at the mouth of the Columbia, in defiance of all rivals.

Misfortune and Massacre

Not lack of pluck, but lack of luck, brought disaster to his enterprises, as in the tragic voyage of the *Tonquin*, made famous by Washington Irving. The *Tonquin* set out from New York in September 1810, with Capt. Jonathan Thorn, of navy traditions, loathing his passengers. He entered the mouth of the Columbia in March 1811, and landed the most troublesome of the Nor'westers, who proceeded to squabble about the building of the new Fort Astoria. On sailed Thorn, more and more nettled by the rough Nor'westers. Contrary to their earnest advice, he allowed several canoes of Nootka Indians to come aboard off the west coast of Vancouver Island. The braves traded their furs for knives and guns, then turned on the white men and massacred them in cold

blood on deck or tossed them, wounded, to the knives of the waiting squaws. A few took refuge under the hatchways, and in desperation blew up the vessel, all going down in a ruin of blood and flame.

This was only the first of the mishaps to Mr. Astor's plans. Meanwhile, other American companies had been springing up. Manuel Lisa, a New Orleans Spaniard, began to trade for furs with the Osage Indians about St. Louis, organized the Missouri Fur Company, and so began the leadership of St. Louis in the fur trade. His men traded in the dangerous country of the Blackfeet, near the Three Forks of the Missouri, and each 200 trappers had to be accompanied by an armed force of 50 men to fight the savages. When Lisa died, in 1820, his men flocked to another organization which became known as "the Rocky Mountain Men," famous for treachery.

THE FUR FLEET SWINGS INTO QUEBEC



This illustration from Harold Rugg's 'A History of American Civilization: Economic and Social' (Ginn), shows the trappers' canoes approaching Quebec.

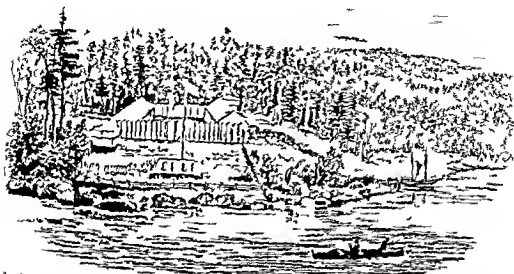


Illustration of Fort Astoria, built by John Jacob Astor at the mouth of the Columbia River in Oregon by the Hudson's Bay Company in 1811. The fort was one of the first of its kind on the Pacific coast and was the headquarters of the company's operations in the Northwest. The illustration shows the fort's location on a riverbank, surrounded by dense trees and a body of water. A small boat with several figures is visible on the river.

Before that time however the War of 1812 had put a new face on the situation. Not long after the war broke out a British gunboat captured Fort Astoria an easy victory because the old Nor-westers in charge of the fort had no heart in a fight against the British. Astor beaten for the time continued to finance American companies from St. Louis and these subsequently split up in American brigades that gave the Hudson's Bay brigades many a losing season in the Rockies where Americans knew their way about.

Foreign Traders Excluded

Also in 1816 the American Congress ruled all foreign traders off of United States soil and the Nor-westers' posts in the United States fell to Mr. Astor's American Fur Company a satisfactory revenge for their coup at Fort Astoria. The Nor-westers had previously received another blow from the Hudson's Bay Company Lord Thomas Douglas Selkirk with large holdings of Hudson's Bay shares planted on Red River a colony of Ordway Island settlers ostensibly to buy crops for inland Hudson's Bay forts. The Nor-westers hotly resented the settlers and their plain rangers caught the local Hudson's Bay governor of Fort Douglas (now in Winnipeg) and massacred him and his company to the last man.

Selkirk distrustful Canadian courts marched a company of Swiss soldiers veterans of the Napoleonic wars up to the Nor-westers' stronghold Fort William on Lake Superior and captured it. He then sent more Swiss back via the ice of the Red River to Fort Douglas and recaptured this from the Nor-westers. But such proceedings were too much like a civil war

for the British government to ignore. Neither company could stand a trial in the courts of London or Canada. The government of Canada through a quiet hint from Great Britain notified both the Nor-westers and Hudson's Bay Company that unless they composed their differences they might both have their charters rescinded. So the two great rivals became the united Hudson's Bay Company celebrating the union with a glum banquet at which the traders of the two old companies glared across the table at each other in unspoken hate.

In the United States the stream of settlers and trappers pouring into the west had by 1831 become a flood. There were Frenchmen from Quebec with Indian wives, gaunt New Englanders in unfamiliar buckskin, adventurers of all kinds following the old Rocky Mountain men stealthily about to learn mountain woodcraft and outfit them at obtaining furs. A torplacé Kenneth MacKenzie an old Nor-wester who could not stomach the union with Hudson's Bay in charge of Fort Union at the mouth of the Yellowstone MacKenzie ruled the place like a little king, dazzled the Indians with his bands of drums and trumpets and stifled and quashed the last hopes of the Rocky Mountain men whose forts he obtained.

Settlers Replace Trappers

But the tide of settlers was too great. Gradually the wild country became too tame for the great fur trade of the past. Fort Union passed into the hands of the federal troops and the trappers of the Rocky Mountain regions grew fewer and fewer. The strange heroics of the trapper in history had been played

He had found the trails which the settlers followed. He had explored and named the lakes and streams and hills. He had learned how to deal with the Indians, so that their full fury was never unleashed upon the settlers, as the history of Canada well proves. He released a primitive source of wealth which built nations.

Today the fur trade operates on less spectacular lines, for the most part, though in the wilds of northern Canada the Indians still trap for the Hudson's Bay Company on the same paternal basis as of old. Strange to say, more furs are now exported from Canada and the United States than in the palmiest days of the old fur trade. One little banking center in western Wyoming has sent out in one year \$600,000 worth of furs, more than Radisson's ships ever carried back to London. No doubt one reason is that furs are no longer the exclusive wear of the rich, but there is a vast demand for cheaper pelts to make popular moderately priced garments.

In the United States alone, millions of pelts are taken each year. Most of them are muskrat, opossum, skunk, raccoon, mink, fox, and weasel, with some squirrel and beaver.

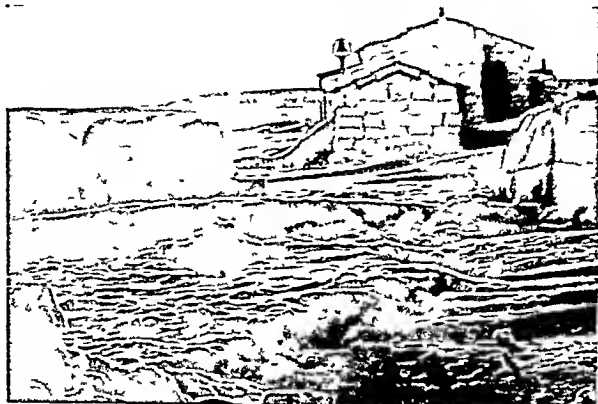
Trapping and Fur Farming

Only a fraction of the huge annual catch is now taken by full-time trappers, who make their entire living by "running" trap lines in the lonely timber of the North and West (see Traps and Trapping). The place of the old-time trapper has been more than filled, however, by the thousands of woodsmen and farmers who trap as a sideline. To encourage fur-bearing animals to live in farm marshes and woodlands, many farmers build artificial dens, grow food supplies, and protect the dens and burrows from fire and from grazing livestock.

In Louisiana, sprawling squat domes of mud and marsh grass mark miles of bayous and swamps as "muskrat farms." The "farms" are merely marshes where the food supply is protected and the trapping is carefully regulated by state law to insure an abundance of muskrats from season to season. These conservation measures have made Louisiana the chief fur-producing state. It takes from 2 to 8 million muskrat pelts a year. From late autumn to midwinter,

trappers and their families camp in marsh shacks, and patrol their lines in pirogues. Some have their own trapping land. Many others trap "on shares," often for large landowning companies. In other states with great marshy stretches, such as Delaware, New

WHERE FURS ARE STORED IN UNGAVA LAND



In this lonely wooden house, insulated with snow blocks, lives a factor of the Hudson's Bay Company in Ungava Land, on the east rim of Hudson Bay. The bell rings, calling the Indians to worship, or it sounds an alarm when the wild north has brought danger. Few of civilization's comforts reach these outposts of the fur trade.

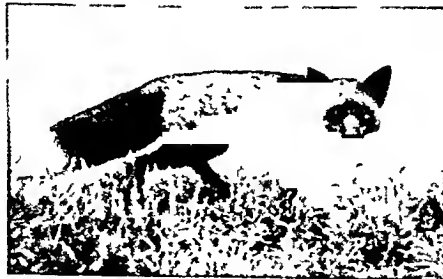
Jersey, and those on the Great Lakes, trappers have developed similar "farms." More muskrats than any other fur bearers are taken. They are the leading source of moderately priced fur coats.

Trapping has become a major industry in Alaska. Indians and Eskimos trap silver fox, ermine, and other prized fur animals.

But in the United States such costlier furs are produced almost entirely by fur farms, or fur ranches. There fox and mink are raised

like domestic animals, in clean pens, fed on careful diets, and selectively bred. The leaders in the industry are Wisconsin, Michigan, Minnesota, New York, Washington, and Oregon. Silver fox farming began in 1890 on Prince Edward Island.

A FINE SPECIMEN OF SILVER FOX



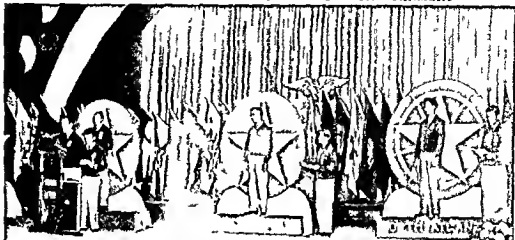
The powdering of silver in the fur on the back and face, the white tail tip, and deep glossy fur are what make a silver fox pelt valuable.

Though its production is greater than that of any other country, the United States imports for its own use or for processing and export even more than it produces. Chief imports are karakul, ermine, squirrel, hare, and fitch from Russia; rabbit and coneys from Australia; marten and mink from Canada; weasel and lamb from China; karakul from Afghanistan and southwest Africa; ocelot, nutria, otter, and hare from Latin America.

New York City and St. Louis are the leading markets for both dressed and undressed furs. The annual value of the United States fur industry has reached about \$500,000,000.

For use in garments, the pelts must be scraped, wetted, dried by heat and fans, tanned, oiled, and beaten with rattan rods to fluff and gloss the fur. To make use of every part, skilled cutters slash the pelts into several pieces, then stitch them together like bits of a puzzle. For costly coats, only the "heart" of each pelt is used, and so the pieces are large and regular. The Fur Products Labeling Act of 1952 requires that furs be described by name of animal and country of origin. A list of furs with their trade names is in the FACT-INDEX at the end of this volume.

HONORING AMERICA'S OUTSTANDING YOUNG FARMERS



Impressive ceremonies mark the presentation of awards to Future Farmers of America whose achievements have been out-

standing. This picture shows the presentation of the Star Farmer of America award made annually at Kansas City, Mo.

FUTURE FARMERS OF AMERICA The most prosperous single group of like age in the world is the Future Farmers of America. Most of the more than 3,000 members of this national farm boys organization earn \$2,000 or more from their farming activities before they are 21. Some boys earn much more than that amount.

Boys studying vocational agriculture in high school are eligible to join the Future Farmers of America (FFA). In the vocational agriculture classroom FFA members study agriculture and practical scientific methods of farming. Classroom training is taken directly to the farms of members where each boy is required to conduct a supervised farming program. This may include the raising of livestock, poultry or crops. Thus an FFA member learns from both school and practice proper soil treatment, fertilization, crop rotation, livestock feeding and management and all the things it takes to make a farm run smoothly.

In addition each FFA member earns while he learns. Under the direction of the vocational agriculture teacher, who is an agricultural college graduate employed on a year-round basis, the boy earns money from his own farm project. If the project is a failure, he takes the loss like any other businessman.

The various activities of the FFA provide experiences in leadership, co-operation, community service and recreation that help build a well-rounded successful farm citizen.

Steps Toward Becoming a 'Star Farmer'

A boy becomes eligible to join the FFA when he is a freshman in high school. He remains eligible until he is 21. He is initiated into the school's chapter as a Green Hand. First he works for a promotion to the degree of 'Chapter Farmer'. In order to qualify he must earn or productively invest \$25, must learn how to lead a group discussion for a quarter of an

hour and must be familiar with parliamentary procedure. He must also know the constitution and program of his organization.

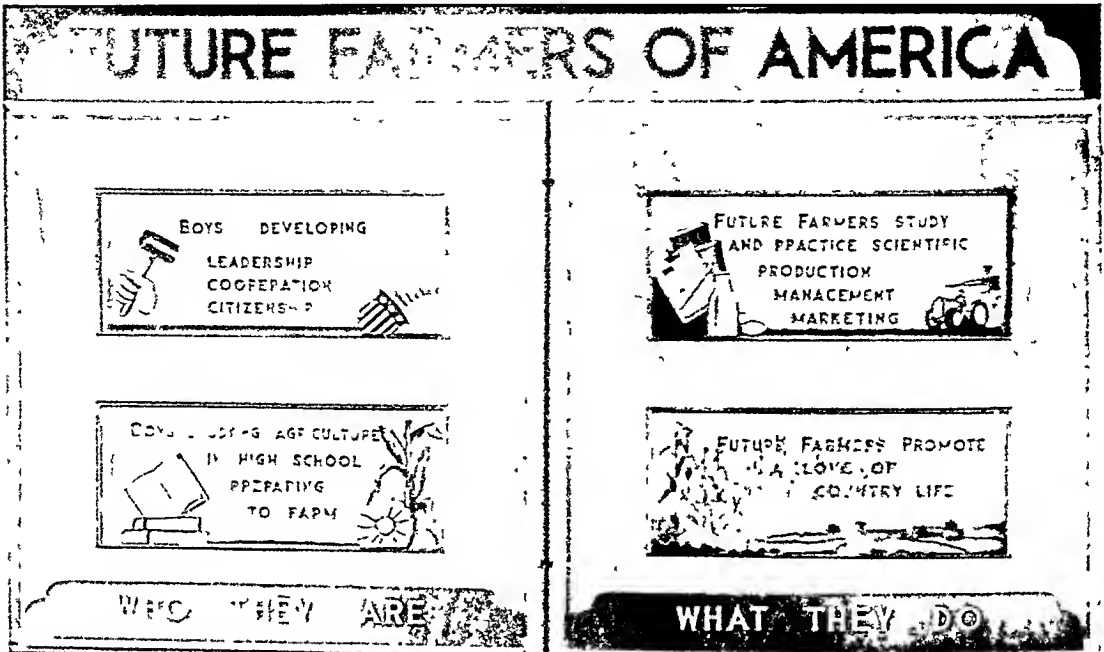
To reach the coveted degree of State Farmer he must have two years of vocational agriculture and carry on an important farm program. He must also earn by his own efforts as much as \$250 and must be in the upper 40 per cent of his class in all school subjects. In addition to these qualifications he has to know how to preside over a meeting, must lead a 40-minute discuss on group and must have taken a leading part in activities for community improvement.

To achieve the American Farmer degree a boy has to earn or productively invest \$500 and must

PURPOSES OF THE FUTURE FARMERS ORGANIZATION

- To develop competent aggressive agricultural and rural leadership.
- To encourage intelligent choice of farming occupations.
- To encourage members in the development of individual farming programs.
- To encourage members to improve the home, the farm and surroundings.
- To participate in worthy undertakings for the improvement of agriculture.
- To practice and encourage thrift.
- To develop character, train for useful citizenship and foster patriotism.
- To participate in co-operative effort.
- To provide and encourage the development of organized rural recreational activities.
- To strengthen the confidence of farm boys and young men in themselves and in their work.
- To encourage improvement in scholarship.
- To create and nurture a love of country life.

FUTURE FARMERS OF AMERICA EXHIBIT FOR A STATE FAIR



To reach the degree of "State Farmer" in the Future Farmers of America organization a boy must study vocational agriculture

for two years. He must also carry on an important farm program. Above is an exhibit made by one "State Farmer" for a state fair.

have had in operation a four-year program of farming in which he has shown wise planning, a healthy growth, and good management. His farm has to pass a rigid test by the state adviser. In addition, his bid for the honor must be recommended by the Board of Trustees and get a majority vote of the delegates at the national convention of Future Farmers.

At the national convention a boy from each of the country's four regions is chosen a "Star Farmer" on the basis of what is considered the best all-round farming record in his region. From these four regional honor winners the "Star Farmer of America" is finally selected.

In addition to carrying on individual projects, many high-school FFA chapters engage in co-operative programs and community enterprises, such as reforestation programs and projects for beautifying their communities. Future Farmers are considered among the best credit risks by rural banks.

National System of Awards

A major part of the FFA program is the national system of awards for outstanding achievement in farming and leadership. These are made possible by the FFA Foundation, which receives its funds by grants from business and industrial firms, organizations, and individuals. The foundation's award program annually totals more than \$150,000. In addition, many other awards are made at local and state

levels. These are given by business firms, organizations, and individuals.

Future Farmer History

The FFA is under the supervision of the United States Office of Education. It grew out of the Smith-Hughes Act of 1917, which established government-sponsored courses in vocational agriculture in public high schools. The FFA became a national association in 1928 and was chartered by an act of Congress in 1950. There are more than 10,000 chapters in all states of the United States, Hawaii, and Puerto Rico. State supervisors of vocational agriculture as well as vocational agriculture teachers serve as advisers. Nationally the FFA is directed from the office of the Chief of Agricultural Education, United States Office of Education. A national convention is held each year at Kansas City, Mo.


New Farmers of America

An organization similar to the FFA is the New Farmers of America. This organization is for Negro farm boys in states where there are separate schools for Negroes. New Farmers of America groups are also sponsored nationally by the United States Office of Education. On a state basis they are supervised by state Boards for Vocational Education and locally by departments of vocational agriculture in the public schools. Membership is voluntary, and the ages of members range from about 14 to 21 years.

THE EASY REFERENCE FACT-INDEX

GUIDE TO ALL VOLUMES FOR SUBJECTS
BEGINNING WITH

F

TO SAVE TIME
USE THIS INDEX 

EDITOR'S NOTE ON NEXT PAGE TELLS WHY

SPECIAL LISTS AND TABLES

NATIONAL FOOTBALL LEAGUE CHAMPIONS	350
GLOSSARY OF FOOTBALL TERMS	351
NATIONAL AND STATE FOREST AREAS	352
RULERS OF FRANCE	358
FRATERNITIES AND SORORITIES	361
PRINCIPAL FURS OF THE WORLD	369-70

Numerous other lists and tables in the fields of geography, history, literature, science, mathematics and other departments of knowledge will be found with their appropriate articles in the main text

EDITOR'S NOTE

EVERY user of Compton's Pictured Encyclopedia should form the habit of *first* turning to the Fact-Index section at the end of each volume when in search of specific information. This index is a miniature work of reference in itself and will often give you directly the facts, dates, or definitions you seek. Even when you want full treatment of a subject, you will usually save time by finding in the index the exact page numbers for the desired material.

All page numbers are preceded by a letter of the alphabet, as A-23. The letter indicates the volume. If two or three page numbers are given for the topic you are seeking, the first indicates the more general and important treatment; the second and third point to additional information on other pages. Where necessary, subheadings follow the entry and tell you by guide words or phrases where the various aspects of the subject are treated.

The arrangement of subheadings is alphabetical, except in major historical entries. In these the chronological order is followed.

The pictures illustrating a specific subject are indicated by the word *picture* or *color picture* followed by a volume indicator and a page number. A picture reference is frequently intended to call attention to details in the text under the illustration as well as to the illustration itself. This picture-text, therefore, should always be carefully read. The pictures are usually on the same page as the text to which you are also referred; sometimes they are found in a different but related article which will add interest and information.

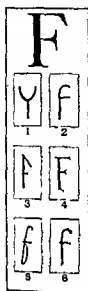
The pronunciations given are those preferred by the best and most recent authorities; alternative pronunciations are indicated where usage is divided.

In recent years hundreds of foreign geographical names have been changed, either officially or by custom. Both old and new names are given at the appropriate places in the alphabet.

Populations are those of the latest census or an official estimate when available if no census has been taken since World War II. Distances between points are map or air distances, not distances by railroad.

THE EASY REFERENCE FACT-INDEX

Vol. IV, No. 66



OUR LETTER F probably began its history as a sign for the sounds of v and w as told in the history of the letter V. (The letter F is closely related to V as you can see if you closely observe the movement of the lips in pronouncing fee and vee. The lee pronunciation is called soft and the vee is called hard or voiced.) In Hebrew the letter was called *vau* or *vav*. Other Semitic languages had similar names. The usual early form was that seen in the Canaanite Phoenician alphabet (1).

When the Greeks learned how to write from the Phoenicians they made varying use of the letter. The eastern or Ionic Greeks needed a sign for the l or v sound but they considered this sound as a sort of p as is shown by their names *phi* and *psi* to mean "I" and p. (The Greek *phi* survives in English spelling in such words as Phoenician and philosophy.) The eastern use of the *vau* sign is explained in the Fact Index article on the letter V. But the Hebrews the Children colonists in Italy and other western Greeks used the sign for the soft version of the *vau* sound. The Chaldeans also gave the little top marks a sideways position (2). The Romans took over the l pronunciation for the sign and straightened its curves (3). The final Latin form (4) of the capital letter came into English without change.

Our small f took shape in late Roman and early medieval times when writers began to use a continuous curving stroke making the top stroke first then the down one, and finally the lower side stroke as in the 5th century Latin writing (5). A more carefully made 9th-century version (6) gave rise to our printed small f.

NOTE—For the story of how alphabetic writing developed from its beginnings see the articles Alphabet Writing.

FAB (Federal Alcohol Administra-
tion) U H 31 205

Fabbe Celesia Bohl van See in Index
Caballero Fernán

Faber (Juher) Frederick William
(1814-81) English theologian and
hymn writer follower of John

Faber Newman joined Roman
(Catholic church 1845) founded re-

Faber Philip (died 1845) founded re-

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Face in building construction See
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- render services to older boys, such as running errands, etc.
- Fa'gin, a crafty old Jew, thief trainer, and receiver of stolen goods in Charles Dickens' 'Oliver Twist'.
- Faguet (fô-gé'), Émile (1847-1916), French critic and man of letters; elected to Academy 1901; professor of poetry at Sorbonne ('Notes sur le théâtre contemporain').
- Fahrenheit (fä-rën-hit), Gabriel Daniel (1686-1736), German physicist and instrument maker; introduced the use of mercury in thermometers; devised Fahrenheit scale: T-116
- Fahrenheit thermometer T-116, picture T-116
- Fahrner, D(elman) S(tater) (born 1898), U.S. Navy officer, born Grove, Indian Territory (now Oklahoma); pioneer in field of pilotless aircraft and guided missiles; director of Pilotless Aircraft Division, Bureau of Aeronautics, U.S. Navy 1945-49; retired as rear admiral 1950: G-225
- Faial, one of the Azores. See in Index Fayal
- Falence (fô-yûis'), a variety of pottery F-396b
- Faille (fâl, French fô-yü'), a ribbed silk dress fabric; softer and with wider, flatter ribs than grosgrain. Fainting, treatment for F-97-8
- Fairbairn (fër-bër'n), Sir William (1789-1874), Scottish engineer and inventor; a pioneer builder of iron ships in Great Britain; with Robert Stephenson, built tubular bridge over Menai Strait.
- Fairbanks, Charles Warren (1852-1918) lawyer and political leader, born Union County, Ohio; U.S. senator from Indiana 1897-1905 See also in Index Vice-presidents, table
- Fairbanks, Douglas (1883-1939), motion-picture actor, producer, born Denver, married Mary Pickford in 1920, divorced 1935 ('Three Musketeers'; 'Robin Hood'; 'Thief of Bagdad'; 'Iron Mask').
- Fairbanks, Thoddens (1796-1886), inventor of compound-lever platform scales; founded, with his brother Erasmus (1792-1864), E. & T. Fairbanks & Co.; both born Brimfield, Mass. scales W-85
- Fairbanks, Alaska, on Tanana River, largest town in interior; pop. 5771; supply point for territory within 300 miles, reached by airplane; gold mining, coal mining, fur farming; University of Alaska; government experimental farm; U.S. Air Force bases: A-132, maps A-135, A-531, C-68, N-250
- Fairchild, David (Grandison) (1869-1954), botanist and explorer, born East Lansing, Mich.; with U.S. Dept. of Agriculture 1889-1935; introduced many plants into America
- Fairchild Tropical Garden B-262
- Fairchild Tropical Garden, in Coconut Grove, Fla.; established 1935 through aid of Col. and Mrs. Robert H. Montgomery; named after Dr. David G. Fairchild; 63 acres: B-262
- Fair Deal, program of President Harry S. Truman T-200
- Fair Employment Practices Committee (FEPC), U.S., proposed federal agency to eliminate racial discrimination in employment; committee under war powers of President F. D. Roosevelt investigated discrimination in war industries and government 1941-46; President Truman in 1948 ordered Civil Service Commission to establish Fair Employment Board to supervise fair practices in federal employment.
- Fairfax, Thomas, Baron (1612-71), English general under Cromwell; victor at Naseby over Charles I (1645).
- Fairfax, Thomas, Baron (1692-1782), American colonist, born England; owned "Northern Neck" and Shenandoah Valley of Virginia (nearly one fourth of present state) bequest to Virginia W-100
- Washington employed by W-18
- Fairfield, Ala., industrial suburb of Birmingham; pop. 13,177; coal, iron and steel products: map A-126
- Fairfield, Conn., summer resort and manufacturing town on Long Island Sound, 51 mi. n.e. of New York City; pop. of township 30,489; chemicals, cast aluminum, fabric-koid; Indian and Revolutionary War battles; burned by Hessians and Tories in 1779: map C-444
- Fairhaven, Mass., city opposite New Bedford on estuary of Acushnet River, at head of Buzzards Bay; pop. of township 12,764; once part of New Bedford, incorporated as Fairhaven in 1812; whaling was once important industry here; boat yards: map M-133
- Fair Labor Standards Act of 1938 (revised 1949), U.S. R-210, L-75
- child labor C-249
- sweatshop methods and S-460
- Fair Lawn, N.J., borough 2 mi. n.e. of Paterson; pop. 23,885: map, inset N-164
- Fairleigh Dickinson College, at Rutherford, N.J.; founded 1941; liberal arts, business, engineering, science, medical arts.
- Fairmont, W. Va., city 55 mi. s.e. of Wheeling; pop. 29,346; glass products, fiber board, cement blocks, bricks, coal, mining machinery; Fairmont State College: maps W-106-7, U-253
- Fairmont State College, at Fairmont, W. Va.; state control; opened 1867; arts and sciences, education.
- Fairmount Park, Philadelphia, Pa. P-189
- Walnut Lane Bridge, picture C-431
- Fair Oaks, battle of (also called Seven Pines), a bloody engagement fought 7 mi. s.e. of Richmond, Va., May 31-June 1, 1862, between Unionists under George B. McClellan and Confederates under Joseph E. Johnston: C-334, map C-335
- Fairs and expositions F-11-14, pictures F-11-13. See also in Index Market
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- history of fairs in U.S. A-64
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- Chicago C-238: Century of Progress (1933-34) C-238, picture F-13; Columbian Exposition (1893) C-232, 238. See also in Index World's Columbian Exposition
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- London: Crystal Palace Exhibition (1851) F-13
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- New York City (1939-40) N-226, picture F-12
- Nijni-Novgorod (Gorki), Russia F-12
- Petroleum Exposition, International T-205
- Philadelphia: Centennial Exposition (1876) P-190; Sesquicentennial Exposition (1926) P-190
- Portland, Ore.: Lewis and Clark Exposition (1905) P-377
- religious fairs, France O-395
- St. Louis: Louisiana Purchase Exposition (1904) S-22
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- trade fairs, or markets F-11-13
- Fairway, in golf G-136
- Fairweather, Mount, volcanic mountain of St. Elias Range in s.e. Alaska; peak (about 15,300 ft.) on Alaska-British Columbia border: A-131, map A-135
- Fairy F-11, picture M-240
- Irish folklore I-234, F-11
- Fairy lilies. See in Index Zephyranthes
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- Lagerlöf L-87
- 'Midsummer Night's Dream' M-240
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- reading interests influenced by R-84a-b
- Faisal I, or Faisal I (fî-sâil) (1885-1933), king of Iraq (after 1921), 3d son of Hussein ibn Ali; leader in Arab revolt (1916); commanded n. Arabian forces in World War I; represented Arabia at Peace Conference: I-225
- Faisal II, or Feisal II (born 1935), king of Iraq; became king 1939; regent rule until May 1953 when he formally took throne: I-225
- Falim, Egypt. See in Index Fayum
- Fake down. See in Index Nautical terms, table
- Falkirs (fâ-kêrz' or fâ'hêrz'), religious ascetics of India
- hypnotism and H-462
- Falaise (fâ-lêz'), a town in n.w. France; pop. 5289; ruined castle, birthplace of William the Conqueror: map E-425
- Falange (fâ-lang'hâ), Fascist party of Spain, founded 1933; became the only legal political party in Spain in 1939, after General Franco's victory in the civil war; members of party called Falangists.
- Falashas (fâ-lâ-shâz'), a Hamitic people of Ethiopia who profess the Jewish religion and claim descent from Jews who followed the queen of Sheba.
- Falcon F-14-15, H-292, pictures F-14, H-292
- sparrow hawk, picture H-292, color picture B-181
- symbol of Egyptian god, picture E-278b
- Falconbridge, Sir (William) Glenholme (1846-1920), Canadian jurist, born Drummondville, Ontario; chief justice of Ontario 1900-1916; knighted 1908.

Key: cöpe, ät, fär, föst, whqt, fgl; mē, yēt, fērn, thēre; ice, bit; rōw, wōn, fōr, nōt, dg; cūre, būt, ryde, fgl, būrn; out;

Family Compact, a political clique in Canada C-98, M-15, Q-8
Family names, origin of N-2a-b
Famine, extreme scarcity of food, caused by drought, insects, etc
 Ireland I-230a
 Russia: (1921) R-289; (1932) R-290
Famine Steppe, in Russia R-261
Fan blower, in ventilation M-270
Fan coral, or sea fan C-476, picture C-478
Fandango (*fán-dáng'gō*), a national dance of Spain, performed in triple time by two dancers with castanets or tambourines, slow becoming develops to intense quickness generally accompanied by music or singing, term also applied to music for the dance
Faneuil (*fán'fī*), Peter (1700-1743), Boston (Mass.) merchant of French Huguenot descent born New Rochelle, N.Y., built and gave to Boston as a market and public meeting place Faneuil Hall called the "Cradle of Liberty" because Revolutionary War patriots met there.
Faneuil Hall, in Boston Mass B-260, A-319, picture B-259
"Fannie May" (Federal National Mortgage Association) I-5, S-1-368
Fanning, James Walker (1804-1836), Texan patriot born Georgia killed at Goliad (1836) with entire force during Texas war for independence
Fanning Island, coral island in Pacific Ocean near equator, pop. 239; belongs to Gilbert and Ellice Islands Colony map P-17
fan cable station C-8
Fan palm P-47, 50, picture P-48
leaf picture L-152
Fantail, See in *Index* Nautical terms, table
Fantail pigeons P-254
Fantasia, See in *Index* Music, table of musical terms and forms
Fanti (*fán-tē*), a Negro tribe of the Gold Coast, West Africa, closely related to the Ashanti
Fantine (*fán-tēn*), in Victor Hugo's *Les Misérables*, mother of Cosette, befriended by Jean Valjean.
Fantin-Latour (*fán-tūn' lá-tōr*), Ignace Henri Jean Théodore (1836-1904), French painter and lithographer; portrayed many celebrated artists and musicians; exquisite flower paintings.
Fan vaulting, in architecture A-317
FAO, See in *Index* Food and Agriculture Organization
Far'ad (named for Michael Faraday), in electricity E-306
Faraday (*fár-á-dá*), Michael (1791-1867), English chemist and physicist F-20, E-308-9, picture F-20
 discovered ions I-205, diagrams I-205
 electrolysis, laws of P-231
 electromagnetic induction F-20, E-304, E-290
Farce, a form of comedy in which plot and situations are exaggerated, the effects often being ridiculous.
Far East, term applied to easternmost countries of Asia, especially China and Japan, with Manchuria and Outer Mongolia; in broader sense includes also Siberia, Indo-China, Siam (Thailand), Malaya, East Indies, and Philippine Islands, and sometimes India, Pakistan, and Ceylon.
Far East, U.S.S.R., an administrative area of R.S.F.S.R. along Pacific coast; includes Kamchatka, Sakhalin, and other regions; map R-260
Faré (*fá-ré*), Guillaume (1489-1565), French reformer and preacher in Switzerland
 Calvin and C-49

Farwell Cape, at s. tip of Greenland, maps N-230, 245
Farwell Address, Washington's (1796) W-26
Fargo (*fár'gō*), William George (1818-81), pioneer expressman, born Pompey, N.Y.; president American Express Company 1868-81; E-458a
Fargo, N.D. largest city in state, near e. border on Red River of the North railroad center in agricultural region, pop. 38,256; distributing point for heavy farm machinery, meat packing; North Dakota Agricultural College; N-291, maps N-289, U-252-3
Fargus, Frederick John (Hugh Conway) (1847-95), English novelist; first won fame as author in 1843 with novel "Called Back" ("Dark Days"), "A Family Affair" "A Cardinal Sin", "Bound Together".
Faribault (*fár-i-bō*), Minn., manufacturing city and educational center 52 mi s of St. Paul; pop. 16,028; trucks furniture, shoes, flour, lumber nurseries; state school for deaf blind, and feeble-minded; maps M-287, U-253
Farigoule, Louis, See in *Index* Romans, Jules
Farinelli (*fá-rē-nē-lē*), Carlo, stage name of Carlo Broschi (1705-32), Italian singer, gifted with a marvelous voice, possessing seven or eight notes more than those of ordinary singers; sang in Vienna and England with great success; in Spain relieved melancholia of Philip V by singing; great influence at court.
Farns, John Thomson (1871-1949), writer, editor, clergyman, born Cape Girardeau, Mo. ("Old Roads out of Philadelphia"; "When America Was Young"; "Book of Everyday Heroism"; "The Romance of Forgotten Towns").
Farjeon (*fár'gōn*), Eleanor (born 1881), English writer of poems, stories, and singing games for children; granddaughter of Joseph Jefferson and sister of Joseph Farjeon ("Martin Pippin in the Apple Orchard"; "Prayer for Little Things"; "Poems for Children").
Farjeon, Joseph Jefferson (1883-1955), English writer of mystery stories born London; grandson of Joseph Jefferson and brother of Eleanor Farjeon ("Mystery in White"; "Friday the 13th", English title "Exit John Horton").
Farley, James Aloysius (born 1888), political leader, born Grassy Point, N. Y.; chairman of Democratic National Committee 1932-40; postmaster general 1933-40
F. D. Roosevelt and R-202
Farley, John Murphy, Cardinal (1842-1918), American Roman Catholic prelate, born Ireland; to U.S. in 1864; was archbishop of New York City 1902; made cardinal 1911.
Farman (*fár-mán*), Henri (1874-1934), French pioneer aviator and airplane manufacturer, born Paris; with brother Maurice (born 1877), built Farman biplane; established early flight records.
Farman bloc, in United States Congress H-267
Farmer Board, Federal, U. S., created 1929 F-20, H-422
Farm Bureau Federation, See in *Index* American Farm Bureau Federation
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Farm clubs, boys and girls A-65
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Future Farmers of America F-326a-b, pictures F-326a-b

New Farmers of America F-326b
Farm credit F-20, A-69, B-47
Farm Credit Administration (FCA), U.S. I-205, F-20, A-69
Federal Farm Board F-20
Farmer, Moses Gerrish (1820-93), inventor and pioneer electrician, born Boscawen (now Webster), N.H.; coinventor of first municipal electric fire-alarm system in U.S. (at Boston); early experimenter in multiplex telegraphy, electric locomotives, and dynamos; invented (1858-59) an incandescent electric lamp having platinum filament.
Farmer in the Dell, a game, picture G-8a
Farmer-Labor party, U. S. L-75, P-360
Farmers' co-operative societies, See in *Index* Co-operative societies
Farmers' Educational and Cooperative Union of America (National Farmers Union), organized in Texas in 1902; more than 5000 local and county unions in 38 states with membership of some 750,000 (includes men, women and young people 16 to 21 years); emphasis is on the farm family living on the family-type farm; national headquarters Denver, Colo.
Farmers' Home Administration, U. S. U-365, A-69
Farmers' Movement, in South Carolina S-294
Farmers of taxes, in ancient Rome R-186
Farmers Union, National, See in *Index* Farmers Educational and Co-operative Union of America
Farm extension service, See in *Index* Federal Extension Service
Farming, See in *Index* Agriculture
Farmington River, a stream in n.-central Connecticut flowing about 100 mi. to the Connecticut River, maps C-438, 444-5
Farm labor, See in *Index* Agriculture, subhead labor
Farm land banks F-20
Farm lands, See in *Index* Land use
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Key: cape, át, fār, fást, what, fāll; mē, yēt, fērn, thēre; ice, bīt; rōw, wón, fōr, nót, dō; cūre, bīt, rīde, fūll, búrñ; out;

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 Farm union See in Index Farmers
 Educational and Cooperative Union
 of America
 Farnese (far nē zā) great Italian
 family including one pope 1 and
 list 1168-1491 great general
 Alessandro Farnese (1549-97) and
 the duke and prince of Parma
 The Farnese name is connected
 with the celebrated palace in Rome
 and with several works of ancient
 art formerly owned by the family
 Farnese Hercules statue H 343
 Fernal (fā nāl) Jeffery (1879-1932)
 English novelist writer of popular
 adventure stories ("The Broad
 Highway The Amateur Gentle
 man The High Adventure
 of Lord of Wasce Another Day")
 Fernalworth Julia Taylor (born 1906)
 television and radio research an
 singer and inventor born Beaver
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 Farns Islands in Atlantic Ocean See
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 Faraok I king of Egypt (born 1900)
 inherited throne at death of father
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 George (1677? 1707) English comic
 dramatist ("The Beaux Strataem")
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 ident University of Colorado 1914-
 16 of Cornell University 1921 37
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 Amer in History")
 Farnes (fā rē) Frederic William
 (1851 1903) English author edu
 cator and clergyman born Bom
 bay India appointed archdeacon
 of Westminster 1893 and dean of
 Canterbury 1895 (L of Christ
 E mal) Home
 Farnes (fā rē) Geraldine (born
 1892) dramatic soprano born Mel
 rose Mass fine dramatic ability
 ("Madame Butterfly Marguerite")
 Faust motion picture Carmen
 Farnell James J (Thomas) (born 1904)
 novel etc writer about social and
 economic inequalities in Chicago
 famous best known for Stud
 Lonigan trilogy ("Young Lon gan
 The Young Manhood of Stud
 Lon gan Judgment Day") and
 novel about Thomas O'Neill

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an d California interested in music
of the American Indian and the
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 litical doctn re F 43 & See also
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 Italy F 43 & I 274 5
 Span S 322 321
 Fascist (fa-shes-iz) organization of
 World War I veterans in Italy
 formed in 1919 gained control of
 government her rhrd Benito
 Mussolini becoming premier F 43
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 Fashet El el f akhr) capital of
 Darfur province former Anglo
 Egyptian Sudan pop 232 0 cars
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 Fashin dail D 122f color picture
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 Fatalism the doctrine that all happen
 ings are foreordained or fixed by
 fate that human in itate or n l
 has no power to direct or change
 the nature or course of events
 Fata Morgana (fo ta mdr po na)
 a fairy in med eval romance pupil
 of Merlin and sister of King Ar
 thur also called Morgana le Fay
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 Baden Powell
 Father of American Betsy John Bar
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 Father of American Football Walter
 Camp
 Father of American shoemaking John
 Adams Dugyt
 Father of the American short story
 Washington Irving
 Father of Angling Isaac Walton
 Father of Chorch History Eusebius
 of Caesarea
 Father of Comedy Aristophanes
 Father of English Empiricism John
 Locke
 Father of English History The Ven
 erable Bede
 Father of English poetry Geoffrey
 Chaucer
 Father of English Printing William
 Caxton
 Father of Epic Poetry Homer
 Father of Geometry Euclid
 Father of Greek Tragedy Aeschylus
 Father of His Country George Wash
 ington
 Father of History Herodotus
 Father of Italian Fraze Ducacono
 Father of Lysa Satan
 Father of Medicine Hippocrates
 Father of Modern Dentistry Greeno
 Vard man Black
 Father of Music Ptolemy
 Father of Romanticism Art Donato o
 Father of Russian Poetry Push us
 Father of Russian Literature M khail
 Lomonosov
 Father of Song Orpheus
 Father of Sympomatic Botany Carl von
 Linné
 Father of Texas Stephen Fuller
 Austin
 Father of the American Navy John
 Barry
 Father of the American Revolution
 Samuel Adams
 Father of the Constitution Ja es
 Madison
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 Fathom'eter, trade name of an ocean-sounding device based on the sonic depth-finding principle N-74, O-336
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 Fatima (fāt'i-mā or fā'ti-mā) (606?-632), favorite daughter of Mohammed, wife of Ali, said to be ancestress of Fatimites.
 Fat'mite Dynasty, Arabian caliphs who ruled Egypt, Syria, and n. Africa 908-1169, claimed descent from Fatima
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 Fat Tuesday. *See in Index* Mardi Gras
 Fatty acids, organic acids derived from open chain hydrocarbons, combined with glycerin in fats and oils G-127, F-45
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 Faubourg (fō-bor'), French term for suburb; sometimes applied to districts that were formerly suburbs, as Faubourg St. Honoré in Paris.
 Faulkner, William (born 1897), novelist and short-story writer, born New Albany, Miss.; writes about South; portrays psychology of abnormal characters; awarded 1949 Nobel prize in literature (novels: 'The Sound and the Fury', 'Absalom, Absalom!', 'Sanctuary', 'A Fable', 1954 Pulitzer prize; short stories: 'Go Down, Moses', 'Knight's Gambit'); A-230c, *picture* N-310
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 Faun, in Roman mythology, goatlike creature corresponding to Greek satyr P-50
 'Marble Faun' G-205
 Fau'na, all the animals of a region or of a division of geologic time.
 Faunce, William Herbert Perry (1859-1930), clergyman, educator, and writer, born Worcester, Mass.; president Brown University 1899-1929 ('The Educational Ideal in the Ministry'; 'What Does Christianity Mean?').
 Fauulero, Little Lord. *See in Index* 'Little Lord Fauntleroy'
 Faunus (fā'nūs), in Roman mythology, rural god identified with the Greek Pan P-50
 lupericalia, dance D-14d
 Faure (fōr), Élie (1873-1937), French art historian and critic, born St. Foy-la-Grande, France ('History of Art', in 5 vols.).
 Faure, François Félix (1841-99), French statesman, president of French Republic 1895-99
 Faure (fō-rā'), Gabriel Urbain (1845-1924), French composer, director Paris Conservatory; at his best in chamber music and songs
 Faure (fōr), Jean Baptiste (1830-1914), French baritone and composer; sang in opera and concert; best known by songs ('The Palms').
 Faust, Johann. *See in Index* Faust, Johann
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 Fauves, Les ("the wild beasts"), group of French painters, first exhibitions of works 1906 P-38
 Fawcett (fō'set), William (1868-1940), American actor, born England; came to U.S. 1888; noted success in Shakespearean plays.
 Favored Nation Clause, a treaty provision I-195, T-17
 Fawcett (fō'set), Henry (1833-84), English statesman, reformer, economist, member of Parliament, and postmaster general; inaugurated parcel post and postal savings bank and insurance; blind from age of 25 ('A Manual of Political Economy'; 'Free Trade and Protection').
 Fawcett, Dame Millicent Garrett (1847-1929), English woman-suffrage leader, wife of Henry Fawcett; created a dame of the Order of the British Empire 1925 ('Political Economy for Beginners'; 'Women's Suffrage'; 'Life of Queen Victoria').
 Fawkes (faks), Guy (1570-1606), leader in Gunpowder Plot F-46
 Fawn, name given to deer, buck or doe, under one year old, *picture* D-45, color *picture* P-420b
 Fayal, or Falal (fā-l'), one of the Azores; 65 sq. mi.; pop. 24,082; chief town Horta A-542
 Fayette, N. Y., town 715 mi. s. of Waterloo, near Cayuga Lake
 Mormon church organized M-392
 Fayetteville, Ark., city in n.w. in Ozark Mts.; pop. 17,071; summer resort; fruit, livestock, grain, dairy products, poultry, hardwood lumber; *maps* A-366, U-253
 University of Arkansas, *picture* A-369
 Fayetteville, N. C., city on Cape Fear River 52 mi. s. of Raleigh; pop. 34,715; tobacco, cotton marketing; cotton and rayon textiles, lumber, plywood; Fayetteville State Teachers College; Fort Bragg and Pope Air Force Base nearby; *maps* N-274-5, U-253
 Fuyolle (fō-yōl'), Marie-Émile (1852-1928), French general, marshal of France; division and corps commander 1914-15; commanded French forces in Somme offensive 1916; commanded central group of armies 1917, northern group 1918.
 Fayum, Faiyum, or Fayūm (fā-yūm'), province of Upper Egypt on w. side of Nile; 670 sq. mi.; pop. 600,000; cap. El Fayum, or El Fayūm (Medinetel-Fayum), pop. 74,314; *maps* E-271, A-46
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 Feast of Tabernacles. *See in Index* Tabernacles, Feast of
 Feast of Weeks, or Pentecost, a Jewish festival occurring 50 days (seven weeks) after the Passover; originally a harvest feast, but later a festival commemorating giving of law to Moses on Mt. Sinai.
 Feather
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 on setter's legs D-116d
 Featherbedding, in labor relations, slang for union rules, common on railroads, limiting output or new materials or processes, or requiring unnecessary or part-time workers allegedly to provide easy jobs or to alleviate unemployment.
 Feathering propeller. *See in Index* Aviation, *table* of terms
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 nuptial plumage B-175
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 goose feathers G-140
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 winter plumage B-175
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 Featherweight, in boxing B-267
 Feather-wing beetle B-104
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 birthdays of famous persons. *See in Index* Birthdays, *table*
 birthstone, color *picture* J-348
 festivals and holidays F-56
 February Revolution, revolution of 1848 in France L-321

Key: cape, at, fār, fōst, what, fall; mē, yēt, fērn, thēre; ice, bit; rōw, won, fōr, nōt, do; cūre, būt, ryde, full, būrn; out;

Fechner (*fěknēr*), **Gustav Theodor** (1801-81) German philosopher and physicist, founder of modern experimental psychology
law of the threshold S 98

Fehleber (*fěk lē ber*) **William Marrow** (born 1890) U S Navy officer, born San Rafael Calif. in service after 1915 became 4 star admiral 1930 commanded U S S Atlantic fleet 1935-37 chief of naval operations 1937-38 appointed commander of North Atlantic Treaty Organization forces in Europe May 1953

Federal Aid Road Act of 1916 U S R 158d

Federal Bureau of Investigation (FBI) U S F 46-6 U 362 pictures I 46 L 362

Fingerprinting II 362

Federal Civil Defense Administration (FCDA) established 1951 to provide a plan of civil defense for the protection of life and property in the United States from attack atomic blast test picture P 88 first and 2 84

Federal Communications Commission (FCC) U S F 1203

Radio P 42 49-40 frequencies classification table II 30

Religion T 64 n d

Federal Council of Churches of Christ in America composed of representatives of the various Protestant denominations organized 1903 first meeting in Philadelphia 1908 See also *United National Council of the Churches of Christ in the United States of America*

Federal courts U S C 460-500

Federal Crop Insurance Corporation (FCIC) U S F 1205 U 305 A 86

Federal Deposit Insurance Corporation (FDIC) U S F 48 B 51

Federal district an area set apart from the states or provinces of a federal nation usually in areas of special national government

Drill future capital D 292 maps D 688 9 262

District of Columbia W 33-4
Ottawa Ontario O 429

Federal Emergency Administration of Public Works better known as Public Works Administration (PWA) U S F 204 208

Federal Emergency Relief Administration (FERA) U S F 1205 206

Federal Extension Service an agency of U S Department of Agriculture. Through this agency the federal government and the states cooperate to carry on out of the classroom instruction in agriculture and home economics in all the 48 states and Hawaii. National headquarters is in the Department of Agriculture in state headquarters in state agricultural colleges. In counties county agricultural agents and home demonstration agents act as advisers working with individuals local leaders and with organizations such as Home Demonstration Clubs and 4 H Clubs. While extension work is done largely in rural areas it is reaching urban communities. Program was initiated through Smith Lever Act passed 1914. Subsequent acts passed by Congress extended program and increased appropriations. Most federal grants are matched equally by states. Total appropriation for year ending June 30 1955 about \$100 000 000 U 385 A 55 F 31 8 See also *Index County agricultural agents* *Feder H Clubs* *Home demonstration agents* *Home Demonstration Clubs*

Federal Farm Bureau U S F 20 H 422

Federal Farm Loan Banks U S F 20

Federal Farm Mortgage Corporation U S F 20

Federal government U S
constitution and U S compared C 91

definition II 368

Federal Hall first United States Capitol built 1799 in New York City on balcony George Washington was inaugurated as first president of the United States picture U 372 national historic site N 20

Federal Housing Administration (FHA) U S R 205 U 368

Federated the way in support of U S Constitution A 226a H 253

Federalists U S political party P 358

Adams John elected president A 13 Allen and Sedition Acts A 167 U 372

Federalism a leader II 253

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Federalism a leader II 253

(1812-85) German chemist born Lübeck professor of chemistry at Polytechnic Institute, Stuttgart did important work in industrial and analytical chemistry introduced Fehling's solution used in testing for sugar in diabetes

Fehling's solution a mixture of copper sulfate potassium hydroxide and potassium and sodium tartrate (Fehling's salt) in water blue color changed by simple sugars (monosaccharides) by maltose and lactose owing to formation of insoluble cuprous oxide but not by cane sugar (sucrose)

Fehmarn (*fě mǎrn*) or **Femern** German island in Baltic Sea n Schleswig Holstein 72 sq mi pop 21 252 agriculture stock raising fishing

Fehrbellin (*fě bē lē n*) Germany small town 35 mi n.w. of Berlin defeat of Sweden under Wrangel by Frederick William the Great

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Fehrbellin (*fě bē lē n*) Germany small town 35 mi n.w. of Berlin defeat of Sweden under Wrangel by Frederick William the Great

- sound absorbed S-237
 Felton, John (1597-1628), English army lieutenant. *See also in Index* Buckingham, George Villiers
- Felton, Rebecca Lattimer (1835-1930), woman suffrage leader, born near Decatur, Ga., appointed to U. S. Senate W-185
- Felucca (*fē-lūk'a*), a Mediterranean vessel, usually undecked, with one or more lateen sails, picture E-270
- Femern Island, in Baltic Sea. *See in Index* Fehmarn
- Feminism W-183-5. *See also in Index* Women's rights
- Femur (*fē'mūr*), the long bone of the upper part of the leg S-192, pictures B-226, S-192
- Fence lizard, or swift, a lizard L-282, 283
- Fencing, a sport F-50-2, pictures F-51-2
- books about H-390
 foil, picture S-484
- Fénelon (*fān-lōn'*), François de Salig-nae de in Mothe (1651-1715), French churchman and author, archbishop of Cambrai and tutor to Louis XIV's eldest grandson, the duke of Burgundy; wrote *Télémaque*, famous didactic tale, children's classic.
- Fengtien, Manchuria. *See in Index* Mukden
- Feng Yu-hsiang (*fūng'yu'hsē-āng'*) (1880-1948), Chinese war lord, amassed large and well-disciplined army; supposedly converted to Christianity but acquired reputation for treachery; joined Nationalist leaders in 1927 but broke with them in 1929.
- Fenian (*fē'nī-dn*) cycle, in Irish literature I-234
- Fenians, Irish revolutionary society which flourished about 1861-72; sought to end English rule in Ireland; active in the United States and made unsuccessful raids into Canada, 1866-70; failure in direct results, but instrumental in convincing Gladstone and others of the need for reforms; name derived from Fianna, legendary band of heroes surrounding Fionn MacCool.
- Fenn College, at Cleveland, Ohio; founded 1881; arts and sciences, business administration, engineering.
- Fennec, name of several species of small, foxlike animals characterized by large pointed ears; they live in desert burrows, hunt food at night; true fennec is found in n. Africa and is pale yellowish red.
- Fennel, an aromatic herb (*Foeniculum vulgare*) of the parsley family with large umbels of small yellow flowers; leaves finely divided into many threadlike parts; seeds used for seasoning, dried leaves for flavoring sauces.
- Fennelflower. *See in Index* Nigella
- Fenner, Phyllis Reid (born 1899), author, librarian, and teacher, born Almond, N.Y.; became school librarian on Long Island, N.Y.; wrote 'Our Library', for adults, and has made many fine collections of tales for children ('Time to Laugh'; 'Demons and Dervishes'; 'Magic Hoofs').
- Fenrir, or Fenris the Wolf, in Scandinavian mythology, monster, child of the evil god Loki; kept chained by magic till Ragnarök (Judgment Day), when he is destined to break loose, spread his jaws to heaven and earth, and, breathing fire, devour Odin.
- Fens, The, marshy low-lying districts in e. England, in Lincoln. Hunting-
- don, Cambridge, and Norfolk counties E-348
- FEPC. *See in Index* Fair Employment Practices Commission
- FERA (Federal Emergency Relief Administration), U. S. R-205, 206
- Ferber, Edna (born 1887), novelist, dramatist, and short-story writer, born Kalamazoo, Mich.; newspaper reporter at 17. Pulitzer prize 1925 for 'So Big' (novels: 'The Girls', 'Show Boat', 'Cimarron', 'Come and Get It', 'Glant'; short stories: 'Emma McChesney & Co.', 'One Basket'; plays with George S. Kaufman 'Dinner at Eight', 'The Royal Family', 'Stage Door'; autobiography: 'A Peculiar Treasury').
- Fer-de-lance (*fēr-di-lāns'*), poisonous snake, *Bothrops atrox*; native to s. Mexico and tropical Central and South America; name means head of a lance and describes its pointed snout; length from 5 to 6 feet
- Martinique M-104
- Ferdinand I (1793-1875), emperor of Austria, succeeded 1835; intermittently insane; informal regency headed by Metternich, governing in his name provoked rebellion which led to abdication (1848), in favor of nephew Francis Joseph.
- Ferdinand I (1503-64), Holy Roman emperor; succeeded his brother Charles V (1556); responsible for Peace of Augsburg; endeavored to establish religious harmony among Catholics and Protestants: A-497 enlarges possessions E-432, H-450
- Ferdinand II (1578-1637), Holy Roman emperor, grandson of Ferdinand I; succeeded in 1619: A-497, T-118-19 flag F-130c, color picture F-128
- Ferdinand III (1608-57), Holy Roman emperor, son of Ferdinand II, whom he succeeded 1637; active in terminating Thirty Years' War; distinguished for scholarship.
- Ferdinand II (1452-1516), king of Aragon, (Ferdinand V, or Ferdinand the Catholic, Spanish King of Castile and Leon); first king of united Spain and patron of Columbus: S-321
- burial place S-320
- Columbus and I-255, C-418, 419, pictures C-418b
- expels Moors: from Spain M-389; from Tripoli L-219
- Inquisition I-151
- Isabella of Castile and Leon, his wife I-255
- Ferdinand I (1861-1948), king of Bulgaria (1887-1918), "the old fox of the Balkans," prince of Saxe-Coburg when elected prince of Bulgaria in 1886; assumed title of king, or czar, 1908; fostered Balkan War 1912-13; entered World War I on side of Central Powers 1915; abdicated in favor of son Boris 1918.
- Ferdinand I (died 1065), "the Great," first king of Castile and Leon; victor over Mohammedans.
- Ferdinand V, king of Castile and Leon. *See in Index* Ferdinand II, king of Aragon
- Ferdinand I (1423-94), king of Naples; able but tyrannical, cruel, and treacherous.
- Ferdinand I (1865-1927), king of Rumania; succeeded his uncle Charles I (1914).
- Ferdinand, kings of Spain. For list, *see in Index* Spain, table
- Ferdinand VII (1784-1833), king of Spain; succeeded on abdication of father, Charles IV, in 1808; deposed by Napoleon same year; restored in 1814; incompetent ruler under whom Spain lost American colonies on mainland: S-322
- Ferdinand I (1751-1825), king of the Two Sicilies (Ferdinand IV of Naples); succeeded 1759; son of Charles III of Spain; stupid, cruel, cowardly; twice dethroned as king of Naples; restored by the Congress of Vienna.
- Ferdinand II (1810-59), king of the Two Sicilies; succeeded in 1830; cruel, treacherous tyrant; earned nickname King Bomba by bombarding rebellious cities.
- Fergana, also Fergann (*fēr-gā'nū*), fertile valley in Asiatic Russia, now part of Uzbek Soviet Socialist Republic; raises cotton, grains, and fruits by irrigation; often invaded through Khujent Pass.
- Fergus Falls, Minn., city in w.-central section, 170 mi. from Minneapolis; pop. 12,917; settled 1873, incorporated 1872; state hospital; cooperative creameries and livestock shipping associations: map M-287
- Ferguson, George Howard (1870-1946), Canadian political leader, born Kemptonville, Ontario, Canada; minister of lands, forests, and mines, Ontario 1914-19; premier and minister of education, Ontario 1923-31.
- Ferguson, Miriam Amanda (born 1875), governor of Texas 1925-27, 1933-35; second woman to be governor of an American state; she claimed her election was vindication of her husband, James E. Ferguson, governor in 1917, who was impeached and removed from office.
- Ferguson, Patrick (1744-80), British soldier; invented first breech-loading rifle used in British army; served with British at Brandywine; killed defending Kings Mountain, S. C.
- Ferguson, Sir Samuel (1810-86), Irish poet and antiquary, president of Irish Academy 1882; his poetry deals with Gaelic traditions ('Lays of the Western Gael').
- Ferguson, Mo., city 9 mi. n.w. of St. Louis; pop. 11,573; residential; match-book covers, cheese products: map, inset M-319
- Ferland (*fēr-lān'*), Jean Baptiste Antoine (1805-65), French-Canadian priest and historian, born Montreal, Canada ('Cours d'Histoire du Canada', 2 vols. of lectures delivered while professor of Canadian history Laval University).
- Fermanagh (*fēr-mān'a*), a county of Northern Ireland; land area 653 sq. mi.; pop. 53,040; county town Enniskillen; scene of much fighting 1921-22: map I-227
- Fermat (*fēr-mā'*), Pierre de (1601-65), French mathematician, born Beaumont-de-Lomagne; helped found modern theory of numbers; often regarded as inventor of differential calculus and, with Pascal, of calculus of probabilities ('Varia Opera Mathematica').
- Fermentation F-52
- alcohol A-145, 146, Y-337
- bacteria produce B-14-15
- bread Y-336, B-295, 296
- Pasteur discovers nature of P-96
- silage S-186
- tea T-30-1
- tobacco T-144
- vinegar V-474
- yeasts cause Y-336, 337
- Fermented liquors A-146
- Fermi, Enrico (1901-54), American physicist, born Rome, Italy; became U.S. citizen 1944; professor physics University of Rome 1927-38, Columbia University 1939-45, University of Chicago (Institute of Nuclear Studies) after 1946;

Key: cāpe, āt, fār, fāst, whqt, fgl; mē, yēt, fērn, thēre; īce, bit; rōw, wōn, tor, not, dg; cāre, bāt, p̄gde, fgl, burn; out;

- St. Patrick's Day P-97, 98
 St. Valentine's Day S-24
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 Thanksgiving T-110, pictures F-58, T-111, color picture C-531
 Twelfth Night C-298
 United States F-55-8, 59
 Yule, or Jol, in n. Europe C-299
- Festus**, Porcius, Roman procurator of Judea about A.D. 60 to 62, before whom apostle Paul was brought for final trial after being left a prisoner by Felix, Festus' predecessor
- Peterlito** (*fét-l-ré-ta*), a grain sorghum introduced into U. S. from Sudan region of North Africa in 1906; grown in the Southwest.
- Fetish**, or *fetich* (*fét-ish* or *fét-ish*), object worshiped as dwelling place or representation of a spirit M-36 doll D-122c
- Fetlock**, upper joint of the toe of horse, picture H-428a
- Fetticus**. See in *Index* Corn salad
- Feuchtwanger** (*foik'trang-tr*). Lion (born 1884). German writer of novels and plays, born in Munich; came to United States 1940; wrote novels of great dramatic force and rich historic background; exiled from Germany 1933 ('The Ugly Duchess'; 'Power'; 'Success'; 'The Oppermanns'; 'Proud Destiny'; 'Tis Folly to Be Wise').
- Feudalism** F-60-2, pictures F-60, 62
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 Froissart's 'Chronicles' F-301
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 knighthood. See in *Index* Knighthood
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 serfs S-196-7, M-238-238a
 shelter S-144a, C-132-5, M-238, 238a, pictures C-132-4
 tithe stone, picture M-238
 warfare M-238c
- Fends**, or *vendettas*, violent quarrels, often hereditary, between families Corsica C-488
 Kentucky K-24
- Fécliant** (*fū-yān'*), a political club organized in Paris during French Revolution; rival of Jacobins; opposed everything not in constitution of 1791; named for religious order that had occupied monastery in which club met.
- Fever**, a condition in which the body temperature rises above normal. See also in *Index* specific name of fever, as Typhoid fever, Yellow fever measured by thermometer T-116
- Fesfew**, a popular garden flower (*Chrysanthemum Parthenium*) of the composite family with tall branching stem, yellowish-green compound leaves, and flowers, with white or cream rays and yellow centers, in large clusters.
- Few**, William (1748-1828), statesman and soldier born near Baltimore; lieutenant colonel in Revolutionary War; signed United States Constitution for Georgia; moved to New York City (1799).
- Fewkes** (*fiks*), Jesse Writter (1850-1930), ethnologist, born Newton, Mass.; authority on archaeology of Cliff Dwellers and Hopi Indians; chief of Bureau of American Ethnology, Smithsonian Institution ('Snake Ceremonials at Walpi'; 'Casa Grande, Arizona').
- Fez**, or *Fés*, Arabic Fes, city of French Morocco, 123 mi. s of Strait of Gibraltar, pop 179,372, caravan trade city for n. Africa; independent from 13th to 16th centuries; gave name to cap M-394, maps A-46, A-167, picture A-52
 basket-weaver's home, picture M-394
 Fez, hairless cap formerly worn by Turks, picture T-207
 Turkish law forbids T-220a
- Fezzan** (*fé-zan'*), province of Libya, in Sahara surrounded by hills; chief city Murzuk L-218, S-16, map A-46
- FFA**. See in *Index* Future Farmers of America
- FHA**. See in *Index* Federal Housing Administration
- FHA**. See in *Index* Future Homemakers of America
- Finna** (*fē-ān'*), legendary band of ancient Celtic heroes surrounding Finn MacCool. See also in *Index* Fenlans; Finn MacCool
- Finnian Foll**, Irish party headed by De Valera I-230b
- Fiat** money, irredeemable paper money made legal tender by edict or statute
 assignats F-293
 Greenback party demands H-298
 U.S. Continentals R-126
- Fintola**. See in *Index* Butterfish
- 'Flibber McGee and Molly'**. See in *Index* Jordan, James Edward
- Fiberglass**, a trade name for glass fibers. See also in *Index* Glass, sub-head fiber
- Fibers** F-62-3, F-4-7, table F-63. See also in *Index* Spinning and weaving; also chief fibers by name
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- R-228, H-333
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 pineapple P-259, P-198
 yucca Y-345
- Fibers**, of muscle M-452-3
Fibers, of nerve N-110-11
 nerve impulse and the synapse N-111-13
- Fibonacci** (*fē-bō-nāt'ché*), Leonardo, known also as Leonardo Pisano (*pī-sā-nō*) (flourished early 13th century), Italian mathematician, born Pisa; his work 'Liber Abaci' provided basis for writings on arithmetic and algebra in succeeding centuries and introduced Arabic notation into Europe.
- Fibrin**, (*fī'-brīn*), in blood plasma B-209, B-145, picture B-208
Fibrinogen, in blood plasma B-209
Fibrilite. See in *Index* Sillimanite
- Fibrous membrane**, membrane composed of fibrous tissue, as the peritoneum around bones and the sheaths of tendons.
- Fibrous roots** R-226, picture R-227
- Fibula**, the outer bone of the leg below the knee S-192, picture S-192
- Fichte** (*fīk'tū*), Johann Gottlieb (1762-1814), German idealistic philosopher who built on the foundation of Kant's teaching; addresses to the German Nation stimulated resistance to Napoleon influence on German literature G-84
- Ficke** (*fīk'ē*), Arthur Davison (1883-1945), poet, born in Davenport, Iowa; infused new life into old forms of poetry ('Sonnets of a Portrait Painter'; 'The Man on the Hilltop'; 'Spectra', with Witter Bynner, a hoax on imagism; 'Chats on Japanese Prints').
- Fiction**, literature devoted to imaginary events, characters, and scenes. See in *Index* Allegory; Drama; Fables; Fairy tales; Novel; Romance; Short story; Stories
- Ficus** (*fī-kūs*), a genus of trees including figs and the India-rubber tree F-65
- Fid**. See in *Index* Nautical terms, table
- Fiddle**, or violin. See in *Index* Violin
- Fiddieback chair**, or splat-back chair I-178, picture I-179
- Fiddlehead**, fern frond F-52, picture F-52
- Fiddler crab** C-503-4, 505
 metamorphosis, pictures C-505
- Fiddle tunes** F-204, picture F-206
- Fidler**, Peter (1769-1822), Canadian fur trader and surveyor, born Bolsover, Derbyshire, England; joined Hudson's Bay Company 1788 and spent rest of life in Canadian Northwest.
- Fidus Achates**. See in *Index* Achates
- Fiedler**, Arthur (born 1894), orchestral conductor, born Boston, Mass.; organized Boston Sinfonietta 1925; conductor, Boston Symphony Orchestra "Pop" concerts from 1930.
- Fief** (*fēf*), in feudal system F-60
- Field**, Cyrus West (1819-92), American businessman F-63, C-7-8
- Field**, David Dudley (1805-94), lawyer and law reformer, born in Haddam, Conn.; brother of Cyrus West Field, Henry Martyn Field, and Stephen Johnson Field; headed 1847 commission to revise legal code of state of New York.
- Field**, Eugene (1850-95), American poet and journalist F-63-4
- Field**, Henry Martyn (1622-1907), clergyman, writer, and editor, born Stockbridge, Mass.; brother of Cyrus West Field, David Dudley Field, and Stephen Johnson Field.

Key: cape, át, fār, fást, what, fǝll; mé, yét, fērn, thérē; ice, bit; rōw, wón, fār, nót, dǝ; cǝre, bǝt, rǝde, fǝll, bǝrn; out;

FIELD

Field John (1782-1857) English composer and pianist born in Dublin, Ireland, wrote piano concertos, romances, quartets, sonatas but chiefly remembered for his nocturnes of which form he was practically the originator. His nocturnes served as models for Chopin.

Field Marshall (1834-1908) merchant and philanthropist, born Connaught, Ireland, came to Chicago in 1856 and early became a business leader, endowed Field Museum, Chicago, later Chicago Natural History Museum.

Field Marshall store development H 374-5

Field Marshall 111 (born 1893) grandson of Marshall Field, born Chicago, president, publishes *Chicago Daily News*, *World Book Encyclopedia*, *Children's* and *Pittsburgh American*. Educational "Paterson's" owns Simon and Schuster Inc. and Pocket Books Inc. and operates radio stations, chairman of board, Parade Publications Inc.

Field Michael pseudonym of Katherine Harris Bradley (1848-1914) born Birmingham, England, and her niece Edith Fane Cooper (1852-1915) born Kentworth, England. English poets who collaborated on lyric poetry and poetic dramas.

Field Rachel Lyman (Mrs Arthur S. Pederson) (1894-1942) author born New York City, awarded Newbery medal for *Henry's story of the wooden doll* 1935, also wrote plays (*Cross the Heart*), poems (*Taxi and Treadstone's Pointed People*), novels (*Time Out of Mind*, *All This and Heaven Too*). *Prayer for a Child*, published after author's death, and awarded 1945 Calverton medal for illustrations by Elizabeth Orton Jones.

Field Stephen Dudley (1846-1913) electrical engineer and inventor, born Stockbridge, Mass., nephew of Cyrus West Field. S 430

Field Stephen Johnson (1816-89) jurist, born in Haddam, Conn., brother of Cyrus West Field. David Dudley Field and Henry Martyn Field, authority on constitutional law, chief justice of California 1829-63, associate justice of U.S. Supreme Court 1863-91.

Field a land area, origin of word A 58

Field a land area, origin of word A 58

Field a land area, origin of word A 58

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(in *Index Chicago Natural History Museum*)

Field officer U.S. Army A 383

Field of the Blackbirds (battia of Kosovo) S 103

Field of the Cloth of Gold plain in France near Calais H 338

Field pattern in radio R 437

Fields James Thomas (1817-81) publisher, author, and lecturer born in Portsmouth, N.H., editor of *Atlantic Monthly* 1857-79.

Fields (Underbrush Yesterday with Authors)

Fields W. C. real name Claude Fields, Dukenfield (1880-1948) comedian born Philadelphia, Pa.

Fields started career as vaudeville juggler, appeared in Ziegfeld Follies 1915-21, in 1922 entered motion pictures (David Copperfield, Alice in Wonderland, Poppy).

Field a small, called *Field*, U 541

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Field a small, called *Field*, U 541

plants shrubs and trees including anemone, foxglove, calceolaria, monkey flower, night phlox, pentstemon, veronica, and nemophila.

Field (H 66) Islands group of more than 800 islands of Pacific, 1083 sq mi, pop. 259,638.

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u=French a German u gem so thin then =French nasal (Jea) a=French f (z in azure) K=German guttural ch

experimental film, picture P-218
microfilm photography M-230-1
motion-picture M-410, picture N-209;
invention M-432; size M-424;
sound M-411, 421, pictures M-411,
420, 423; Technicolor M-418
orthochromatic P-224
panchromatic P-224
Filter, a device which allows solu-
tions to drain, be drawn (vacu-
um type), or forced (pressure
type) through specially prepared
paper, diatomaceous earth, porce-
lain, or other absorbent material,
to remove solid particles or color-
ing matter from the solution: pic-
ture C-385
colors cleared in solution C-385
gases purified C-385
sewage purified S-110
water supply for cities W-72
Filtration. See in *Index* **Filter**
Fin, of animals. See in *Index* **Fins**
Finle (*fē-ū-lā*), the final part or
last section of a musical composi-
tion M-463. See also in *Index* **Mu-**
sic, table of musical terms and
forms
Finance, the work of obtaining and
using money and credit for the sup-
port of private and public enter-
prise. See also in *Index* **Banks** and
banking; **Capital**; **Credit**; **Money**;
National debt; **Taxation**
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trusts T-201-2
Finance company I-165
Finance Corps, U. S. Army A-380
insignia, picture U-238
Finback whale W-114, picture W-113
Fineh, Francis Miles (1827-1907),
poet and jurist, born Ithaca, N.Y.;
best known for lyrics 'Nathan Hale'
and 'The Blue and the Gray'.
Fineh family, a large family of seed-
eating birds F-68, picture F-68
Fineh, Henry Theophilus (1854-1926),
music critic, born Bethel, Mo.; on
New York Evening Post for more
than 40 years ('Wagner and His
Works'; 'Songs and Song Writers';
'Success in Music and How It Is
Won')
Findlay, Ohio, a manufacturing city
and oil center 43 mi. s. of Toledo;
pop. 23,845; petroleum, foundry,
rubber, and clay products; Findlay
College: map O-356
Findley, John, American pioneer and
Indian trader; discovered Cumber-
land Gap about 1765: B-250
Fine, in law. See in *Index* **Law**, table
of legal terms
Fine arts. See in *Index* **Architecture**;
Arts; **Dance**; **Drama**; **Drawing**;
Literature; **Music**; **Painting**; **Po-**
etry; **Sculpture**; **Theater**; **Writing**,
art of
Fingal (*fin-gal*'), a name by which
the legendary Celtic hero Finn
MacCool was sometimes known in
Scottish legend; popularized by
Macpherson's epic 'Fingal'. See
also in *Index* **Finn MacCool**
Fingal's Cave, Scotland C-158, map
B-321
Finger, Charles Joseph (1869-1941),
American author and editor, born
Willesden, England, came to U. S.
1887; traveled in South America,
Africa, Canada, Antarctica, Mexico;

editor *All's Well* 1920-41 ('High-
waymen'; 'Tales Worth Telling';
'Tales from Silver Lands', awarded
Newbery medal 1925; 'Courageous
Companions'; 'After the Great Com-
panions'; 'Give a Man a Horse';
'Fighting for Fur') S-417
Finger, of hand H-255-6, F-69, pic-
tures H-256, S-192, F-69
Finger Lakes, N. Y., narrow lakes in
w. N. Y.; famous scenic region;
popular resort section; grape cul-
tivation; principal lakes: Canan-
daigua, Keuka, Seneca, Cayuga,
Owasco, and Skaneateles: N-208,
210, maps N-204-5, U-265
Fingerlings, in fish culture F-109
Finger millet, cereal M-255
Finger nail S-193, H-426
Finger painting, a method of painting
in which vegetable colors mixed
with starch are applied to wet paper
with fingertips; popular children's
art.
Fingerprints F-69, pictures F-69
classification F-69
Federal Bureau of Investigation
U-362
police use in identification of crimi-
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Finlisterre (*fē-ēs-tēr*'), Cppe ('land's
end'), high promontory on n.w.
coast of Spain; naval victories of
English over French 1747, 1805:
maps S-312, E-425
Finl, Mike (1770?-1823), frontier
Indian fighter in vicinity of his
birthplace, Pittsburgh, Pa., also
a keelboat man on Ohio and Mis-
sissippi rivers; died a violent death
while on a fur-trading expedition
led by William H. Ashley and
Andrew Henry; during his lifetime
and since has been celebrated as a
legendary figure in many tall tales:
F-198
Finland, republic of n. Europe: area
130,119 sq. mi.; pop. 4,029,803; cap.
Helsinki: F-70-2, maps E-417,
N-301, P-346, pictures F-70-1
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Finland, Gulf of, arm of Baltic Sea
between Finland on n. and Russia
on s.; length 260 mi.; width 25 to 80
mi.; maximum depth 262 ft.: maps
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'Finlandin', musical composition by
Sibelius S-171
Finlay, Carlos Junn (1833-1915),
Cuban physician; in 1881 advanced
theory that the mosquito (genus
Stegomyia) is carrier of yellow
fever germ; chief health officer of
Cuba 1902-9: M-402-3, 404, picture
R-88a
Finlay River, Canada, headstream of
Peace River; rises in n.-central

British Columbia; length 250 mi.:
maps C-68, 80
Finlayson, Roderlek (1818-92), Cana-
dian fur trader, born Ross-shire,
Scotland; joined Hudson's Bay
Company in 1837; commanded Fort
Victoria, British Columbia 1844-72.
Finletter, Thomas Knight (born 1893),
public official and lawyer, born
Philadelphia, Pa.; served in World
War I; special assistant to
secretary of state 1941-44; head
of President Truman's air policy
commission 1947-48; secretary of
air force 1950-53.
Finley, John Huston (1863-1940),
educator, editor, and author, born
Grand Ridge, Ill.; president Knox
College 1892-99; professor politics,
Princeton University, 1900-1903;
commissioner of education, state of
New York, and president University
of State of New York 1913-21; as-
sociate editor *New York Times*
1921-37, editor in chief 1937-38
(*'The French in the Heart of
America'*; *'A Pilgrim in Palestine'*;
'The Debt Eternal').
Finl, Francis James (1859-1928),
Catholic priest (Jesuit), educator
and author of books for boys, born
St. Louis, Mo.; director St. Xavier
School, Cincinnati ('Percy Wynn';
'Tom Playfair'; 'Lucky Bob').
Finl, haddock, smoked haddock
H-240
Finney, Charles Grandison (1792-
1875), Congregational minister,
born Warren, Conn.; famous re-
vivalist preacher; became president
of Oberlin College 1852; grand-
father of Kenyon Cox.
Finnish language and literature F-71
Finn MacCool, or **Fionn Macemhail**,
Celtic (Irish) legendary hero,
leader of the Fianna (Fenians);
wooded and won Granian; father of
the bard Ossian: I-234, S-413-14,
K-40
Ossian O-426b
Finn-Tatna, great division of the
human family which includes the
Finno-Ugric peoples of Europe and
the Mongolo-Tatars of Asia.
Finno-Ugric, name of a group of
peoples and languages of the Finno-
Tataric division; includes not only
inhabitants of Finland, but similar
tribes in Russia, as well as the
Ostiaks, Voguls, Magyars, and
other related tribes of Ugric stock,
named from Yura or Ugra, country
on either side of Ural Mts.
Magyars H-448
Finn, people of Finland F-71
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in Delaware D-60
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fish F-101-2, 99, 103, pictures
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porpoise P-375
prehistoric reptiles R-112, 113, pic-
ture R-111
Finsen (*fin'sēn*), Niels Ryberg (1860-
1904), Danish physician, born in
the Faeroes; first to employ ultra-
violet sun rays in treating disease;
invented Finsen curative lamp;
won Nobel prize in medicine 1903.
Finsternhorn (*fin'stēr-ār'hörn*),
highest summit of Bernese Alps;
40 mi. s.e. of Bern, Switzerland
(14,022 ft.).
Fiona Macleod. See in *Index* **Sharp**,
William
Fionn Macemhail. See in *Index* **Finn**
MacCool
Fiords, also **fjords** (*fjörds*), long,
narrow deep arms of sea running
far inland

Key: cape, at, fair, fast, what, fall; mē, yēt, fērn, there; ice, bit; rōw, wōn, fōr, nōt, dō; cāre, būt, rjde, full, būrn; out;

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 greater part Firwood name
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 Fireball in warfare a projectile or
 a bag containing combustible used
 in light up or set fire to defensive
 works of enemy called fires in
 World War I
 Fire boats F 87 pict re F 87
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 Fire cherry or pin cherry C 223a
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 fireproofing a) on olive gun found in
 coal mines its chief constituent is
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 Firestone Harvey Sam set (1869-1924)
 manufacturer of rubber products
 born Columbiana County Ohio
 organized Firestone Tire and Rub-
 ber Co in Akron Ohio in 1890
 led movement for study of rubber
 growing processes thru about
 the world developed a huge rubber
 plantation in Liberia
 Fire truck F 81 83 84 5 pict res
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 toy fire truck pict re T 168b
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 Fire walking a religious rite of old
 and obscure origin consists of
 walking on a bed of stones that
 have been heated by a fire under
 which survives in Tahiti Fiji Is-
 lands and India
 Fireweed or great willow herb a tall
 graceful perennial plant (Epilo-
 bium sp. silvum) having willow
 like leaves and tall spikes of
 purple pink flowers especially
 abundant where ground has been
 burned over W 64 color pict re
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 First day easier in stamp collecting
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 First Folio of Shakespeare's plays
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 First International the International
 Workmen's Association 1864-
 75 C 429
 First in war first in peace and first
 in the hearts of his countrymen
 W 27
 First magnitude star of S 376
 First point of Aries A 440
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 Firh F 87
 Fiscal Commission United Nations
 U 243
 Fiscal inflation See in Index Inflation
 Fiscal Service I S U 860
 Fischer (Fischer) Emil (1852-1910)
 German chemist professor of
 chemistry at Wurzburg and Berlin
 on various subjects produced simple su-
 gar and other organic substances
 synthetically with Abderhalden
 laid foundation of enzyme chemis-
 try won Nobel prize 1907
 Fischer Hans (1881-1945) German
 chemist professor of organic chem-
 istry at Munich first title of Terh-
 nology won Nobel prize in chemis-
 try 1930 for theory of structure of
 hemoglobin
 Fish Hamilton (1658-93) U S sec-
 retary of state in both of Grant's
 administrations 1869-77 father of
 Gloucester fish had part in
 settling Alabamian claims
 Fish Streetmarket (1841-1932) Ance-

- can banker and railroad official, son of Hamilton Fish; president Illinois Central Railroad 1887-1906; held high positions in railroads, banks, and corporations; published 'The Nation and the Railways'.
- Fish F-99-108, pictures F-99-103, 106-8, color picture F-104-5. See also in Index Aquarium; Fish culture; Fisheries; also names of various fishes, as Bass, Carp, Shark
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- Fisher, Dorothy Canfield. See in Index Canfield, Dorothy
- Fisher, Frederick Bohu (1882-1938). Methodist Episcopal bishop born Greencastle Pa.; bishop at Calcutta, India 1920-30 ('India's Silent Revolution': 'Which Road Shall We Take?').
- Fisher, Geoffrey Francis (born 1887). English divine, archbishop of Canterbury from 1945 headmaster, Repton School, in Derby County, 1914-32; bishop of Chester 1932-39; bishop of London 1939-45.
- Fisher, Harrison (1877-1934), illustrator, born Brooklyn N.Y.; won popularity through well-known type of American girl.
- Fisher, Harry Conway (Bud) (1884-1954), cartoonist, born Chicago, Ill.; created 'Mutt and Jeff'; first to draw a daily comic strip and to syndicate his work widely.
- Fisher, Herbert Albert Laurens (1865-1940), English historian, born London; president Board of Education 1916-22; member of Parliament 1916-26; warden New College, Oxford University, 1925-40; president British Academy 1928-32 ('A History of Europe').
- Fisher, Irving (1867-1947), economist, born Saugerties, N. Y.; professor political economy, Yale University, after 1898; editor *Yale Review* 1896-1910; author of works on mathematics and political economy.
- Fisher, John, Saint (1459-1535), English bishop, chancellor of Cambridge; friend of Erasmus; opposition to Henry VIII's divorce and refusal to recognize him as head of the church led to execution; canonized 1935.
- Fisher, Peter (1782-1848), Canadian historian, born Staten Island, N.Y.; settled at Fredericton, New Brunswick, Canada, and known as first historian of New Brunswick ('Sketches of New Brunswick, Containing an Account of the First Settlement of the Province').
- Fisher, Sir Ronald Aylmer (born 1890), English geneticist and educator, born London, England; professor of eugenics Oxford University 1933-43; professor of genetics Cambridge University after 1943; B-154, 155
- Fisher, Vardis (born 1895), educator and author, born Annis, Idaho; professor of English at University of Utah 1925-28, New York University 1928-31; early known for tetralogy about turbulent life of autobiographical hero ('In Tragic Life', 'Passions Spin the Plot', 'We are Betrayed', and 'No Villain Need Be'); 'Children of God' historical novel about Mormons.
- Fisher, black marten, or pekan M-104
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- United States Coast Guard protects C-371
- Fisheries, Bureau of, former bureau of U. S. government; combined with Bureau of Biological Survey 1940 to form Fish and Wildlife Service. See also in Index Fish and Wildlife Service
- Fisherman, a game G-8d-e
- Fisherman's Wharf, in San Francisco, Calif. S-410, picture S-41b
- Fisher of Kilverstone, John Arbuthnot Fisher, first Baron (1841-1920), British admiral; entered navy 1854; first sea lord of British admiralty 1904-10 and 1914-15; forceful naval reformer; first to introduce use of dreadnoughts.
- Fisher's Hill, battle of, fought 20 mi. s. of Winchester, Va. (Sept. 1864)
- Sheridan at S-147
- Fishes. See in Index Pisces
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- Fishguard and Goodwick, Wales, urban district, seaport of Pembrokeshire in N. on Fishguard Bay; pop. 4840; excellent harbor; fisheries; Fishguard Invasion of French under General Tate, Irish-American adventurer (1797): map B-325
- Fish hawk, or osprey H-292-3
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- Fishhook cactus, or pencil cactus, color picture C-12
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- bait casting F-118b-d, pictures F-118c
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 Fish (James) (Jim) (1894-1962) financial accumulator born Dennington Vt associated with Daniel Drew and Jay Gould in Erie railroad gained millions and caused wide ruin by attempted corner of gold market ending in Black Friday panic of 1869 shot and killed by a former associate
 Fish Bradley Allen (1854-1942) U.S. Navy officer and inventor born Lyons N.Y. rear admiral U.S. Navy 1911-16 invented naval telescope sight resulting in great improvement in naval gunnery and other devices for warships
 Fish John (1842-1901) historian and philosopher born Hartford Conn. his clear charming style popularized the theory of evolution and a philosophic view of American history "The Critical Period of American History" "The Discovery of America" etc form practically a connected history
 Quoted on Magellan's voyage M 33
 Fish Attente Madren (1865-1932) actress born New Orleans La. appeared on stage from early child hood - acting had great intellectual and dramatic power famous for her Ibsen roles and for parts of Becky Sharp and Mrs. Matapop
 Fish Jobilee Singers a group of Negro singers affiliated with Fisk University organized 1871 and toured in U.S. and abroad internationally famous for interpretation of Negro spirituals and folk songs
 Fish University Nashville Tenn. founded 1862 high school liberal arts music business administration graduate studies
 Fishion in biology See in Index Cell abstract division Reproduction a strict sense at flow on
 Fishion atoms A 484 diagrams A 485 486 487
 Fishion fossil See in Index Schizonychia
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 Fish John (1743-98) American in vent F 118-b
 steant at picture T 171
 Fish William Clyde (1865-1909) playwright born New York City N.Y. popular to his time and also the model for a biographer often careless writer "The Climb" "The Truth" "The Girl with the Green Eyes"
 Fish name given to the European and S. American polecat and its fur fish is a mammal related to the weasel - hair short color dark brown and yellow
 Fishness Mass. an industrial city 41 mi. w. of Boston pop. 42,641 paper textile machinery blowers firearms saws State Teachers College map M 132
 paper mill picture U 281
 Fish Mary (1574-1654) a maid of honor to Queen Elizabeth I supported by some to be the dark lady of Shakespeare's sonnets
 Fish prefix in surnames N 28
 Fishville pen name of William Makepeace Thackeray T 168
 Fisher Edward (1809-63) English poet whose famous translation "Rubbish of Omar Khayyam" is an almost unique instance of successful translation of a foreign poem E 380a
 Fitzgerald Francis Scott (1896-1940) novelist born St. Paul Minn. set new fashion in "This Side of Paradise" depicting revolt of youth of other novels "The Great Gatsby" "Tender is the Night" "The Last Tycoon" short stories "Flappers and Philosophers" "All the Sad Young Men"
 Fitzhugh James (1760-1833) British soldier born Ireland served in Napoleonic Wars in Canada in War of 1812 and in rebellion of 1837 became adjutant general
 Fitzmaurice James Irish aviator hometown Night Europe to America table A 104
 Fitzpatrick Thomas (1795-1854) American fur trader and trapper ranked with Carson and Bridger member of Ashley's expedition up the Missouri 1823 with Bridger and William Sublette formed Rocky Mountain Fur Co. 1839 guide to Dr. Snow Elkmont Kearns and Abert became agent to Indians A 620
 Fitz Carson and C 123a 123b
 Fivero River one of chief rivers of Western Australia very public about 200 mi. flows into Indian Ocean map A 485
 Fitzsimmons Robert Prometheus (Bob) (1866-1917) Australian boxer born Heistown Cornwall England heavy-weight champion B 271 table B 272
 Fitzsimmons Thomas (1741-1811) American politician leader bust member of Revolution advocated Hamilton's policies a member of Federal Convention (1787) signed United States Constitution for Pennsylvania congressman from Pennsylvania 1789-93 influential in founding Bank of North America and in obtaining protection for tariff
 Flume (fyo ma) Serbian Rijeka (referred to) Yugoslavia seaport near head of Adriatic Sea pop. 75,112 P 118; maps 1 282 U 416 425
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 Five foot shelf of books known as Harvard Classics origin E 329
 Five Forks battle of fought April 1 1865 11 mi. w. of Petersburg Va. Sheridan at S 147 map C 335
 Five freedoms of family life F 17
 Five formidable Arts against American colonies R 129 134 135
 Five lined Albatross a smooth crested lizard L 282-3
 Five Nations confederacy of five tribes of Iroquois Indians formerly living in central and western New York I 108d See also in Index Iroquois
 Five power treaty (1922) to reduce naval armament N 33 H 467
 Five spot See in Index Nemophila
 Five star admiral See in Index
 Five star general See in Index
 Five star general See in Index
 Five Towns traditional name for Turnhill Burnside Hanley Stoke on Trent and Longton since 1929 forming with Fenton the city of Stoke on Trent in N. Staffordshire England in Arnold Bennett's novels represented by Turnhill Burnley Hanbridge Kynye and Longshaw picture E 355
 Five year plans Russia F 290
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 Fixed condenser in radio R 38 diagram R 38
 Fixed fats and oils F 240-1 See also in Index hydrogen N 240-1
 Fixed nitrogen a blood fixation
 Fixed trust T 261
 Fixed trust T 261
 Picture in law See in Index Law table of legal terms
 Fixation (fio fio) Armand Hippolyte Louis (1819-96) French physicist in 1849 invented a reliable method of determining time that light takes to travel a distance on the earth F 284
 Flade See in Index Flords
 Flaccus Quintus tertius (Horace) (65-8 B.C.) Latin lyric poet L 131 S 185 picture R 181
 Flack Barbara (born 1897) author and illustrator of children's books born Greenport L.I. N.Y. married William Ross Leitch 1941 (Ask Mr. Dear Editor of the River)
 Flac See in Index Flaga
 Flac an Irish I 352
 Flac Day (June 14) U.S. F 67 F 122
 Flagella (flu gela) the hairlike appendages of some bacteria B 13
 Flagellants (fage lla) a fanatic religious sect of medieval Europe members scourged themselves to atone for sin (picture cleaned sinners still practiced by Penitentes sect of Mexicans of New Mexico and Colorado)
 Flagellate class of unicellular animals with one or more whiplike appendages or flagella, picture L 234d
 Flagolet (fag o let) a musical instrument somewhat similar to the flute tone more mellow blown

from end instead of side; invented at end of 16th century.

Flaget (*flā-zhā'*), Benedict Joseph (1763-1850), French missionary, born Contournat, France; first Roman Catholic bishop of old Northwest Territory, with See at Bardstown, Ky.; ministered to Indians at Fort Vincennes 1792-95; professor at Georgetown University 1795-98, at St. Mary's, Baltimore, 1801-10; appointed bishop 1810.

Flagg, Ernest (1857-1947), architect, born Brooklyn, N.Y.; designed Singer Building, New York City, Corcoran Gallery of Art, Washington, D. C., and U. S. Naval Academy, Annapolis, Md.; author of 'Small Houses—Their Economic Design and Construction'.

Flagg, James Montgomery (born 1877), author and illustrator, born Pelham Manor, N.Y.; contributor to magazines; wrote and illustrated 'The Adventures of Klitty Cobb', 'The Mystery of the Hated Man'.

Flagler, Henry Morrison (1830-1913), American capitalist.

Florida development F-161

Miami founded M-211

St. Augustine hotels S-17

Flag officer, a navy officer whose rank entitles him to fly a special flag at the masthead of ships under his command; in the U. S. Navy, a fleet admiral, admiral, vice admiral, rear admiral, or commodore.

Flag of truce, a white banner hoisted during a conflict indicating a desire to communicate with the enemy; the bearers of the flag are respected and protected.

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use and display F-123-4, pictures F-120, 121

Flag signals S-179, pictures S-178

Flagstad (*flāg'shtāt*), Kirsten (born 1895), Norwegian dramatic soprano; noted for Wagnerian operatic roles with Metropolitan Opera in New York City for many years; acclaimed for acting ability and for the remarkable power and quality of her voice.

Flagstaff, Ariz., city, a health and tourist center, in n.-central part of state; pop. 7663; lumber mills; Arizona State College; Southwest All-Indian Pow-Wow each Fourth of July week end; maps A-352, U-252

Lowell Observatory A-344, P-285

Flaherty, Robert (Joseph) (1884-1951), explorer and pioneer documentary film producer, born Iron Mountain, Mich.; explored n.e. subarctic Canada 1910-16; films: 'Nanook of the North', 'Man of Aran', 'The Louisiana Story'

Nanook, picture F-321

Flail, in threshing F-124

Flak, barrage of antiaircraft fire.

Flak shifts A-377

Flame F-74

bunsen, parts of B-353

candle, parts of B-352-3

oxycetylene A-7

oxyhydrogen H-459

Flame flower. See in Index Kalphofia

Flameleaf sumac, or dwarf sumac F-349

Flamenco (*flā-mēn'g'kō*), name applied to Andalusian gypsies of Spain, also to their lively and fiery dances; in recent times word sometimes applied to all nonformal Spanish dancing and music.

Flame thrower, in warfare C-208, pictures A-382

Flame tree, evergreen tree (*Brachychiton acrifolium*) of sterculia family, native to Australia but widely grown in California; 25 to 60 ft.; leaves to 10 in. wide, maple-like, glossy; flowers scarlet, in large clusters; fruit black pod, to 4 in. long.

Flamingo F-139, pictures F-139

food in captivity Z-357

foot, picture F-225

scarlet F-139, color picture B-180

Flaminian Way (*Via Flaminia*), road from ancient Rome to Ariminum (modern Rimini), constructed by censor Flaminius (220 B.C.) R-194

Flaminianus (*flām-in-i'niūs*), Titus Quintus (228?-174 B.C.), Roman general, victor of Cynoscephalae (197 B.C.) and "liberator of the Greeks."

Flaminius (*flā-mīn'i-lis*), Gaius (died 217 B.C.), Roman general and censor; built Circus Flaminius in Rome and the Flaminian Way; slain in battle with Hannibal.

Flammarion (*flā-mā-ryōn'*), Camille (1842-1925), French astronomer; wrote popular scientific books ('Marvels of the Atmosphere').

Flamsteed, John (1646-1719), English astronomer; astronomer to Charles II; wrote 'Historia coelestis Britannica', a 3-volume work on his observations; 3d volume catalogues about 3000 stars.

Flanagan, Edward Joseph (1886-1948), Roman Catholic priest and founder of Boys Town, Neb., born Roscammon, Ireland; came to U. S. 1904, became citizen 1919; founded

Home for Homeless Boys in Omaha in 1917, later moved 10 miles w. of Omaha and established Boys Town. See also in Index Boys Town

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Flanders, battles of (Ypres and Passchendaele Ridge), World War I W-227

Ypres destroyed Y-344

'Flanders Fields, in', poem by John McCrae P-370

Flandin (*flān-dān'*), Pierre-Étienne (born 1889), French political leader, born Vichy, France; favored appeasement policy; prime minister 1934-35; foreign minister 1936 and in the Vichy government 1940-41.

'Flandre', French ocean liner, picture F-274

Flank, cut of beef, picture N-156b

Flanks, position of riders driving a herd of cattle C-151

Flannagan, John Bernard (1895-1942), sculptor, born Fargo, N. D.; known for abstract sculptures of simplicity and originality, done chiefly in field stone; S-82

'The Frog' S-82, picture S-82

Flannel, a loosely woven woolen fabric with soft surface, with or without nap.

Flannelbush, evergreen shrub or small tree (*Fremontia californica*) of sterculia family, native to California. Leaves have 3 to 5 lobes; flowers large, yellow, with 5 petals.

Flap. See in Index Aviation, table of terms

Flare, or fireball. See in Index Fireball

Flash boiler, for early steam cars A-504

Flashing. See in Index Architecture, table of terms

Flashlight, small electric hand lamp with self-contained battery

consumption of lamps for E-311

making photographs with, picture P-216

Flashlight photography P-215

Flat, in architecture. See in Index Architecture, table of terms

Flat, in musical notation M-468a

Flatboat P-264, pictures M-309, P-265

fur traders', picture F-40

Flatbush, now part of borough of Brooklyn, New York City; Flatbush Pass, strategic point in American Revolution.

Flat-coated retriever, dog, table D-118

Flat fell, a seam S-112-13

Flatfish F-139-40, pictures F-139-40

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Flathead catfish, or yellow catfish C-138-9

Flathead Indians. See in Index Salish

Flathead Lake, Mont., 40 ml. s. of Glacier National Park; 188 sq. ml.; maps M-367, 374

Flathead River, Mont., issues from s. end of Flathead Lake and enters Clark Fork after course of 75 ml.; fruit-growing region; map M-374

Hungry Horse Dam M-377, map M-367, picture D-9

Flatiron

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- Flint and steel, in making fire M-140, picture F-75
 Flint corn C-485, picture C-485
 Flint glass, or crystal glass G-122a
 prism refracts light R-30e
 use in telescope T-47
 Flint head, popular name for wood ibis S-402
 Flintlock musket F-76, picture F-77
 Flint River, Ga., rises near Atlanta and flows 350 mi. to s.w. corner of state where it joins Chattahoochee to form the Apalachicola, drains area of about 8,000 sq. mi. maps G-70, 76-7
 Float, a platform on wheels on which mounted exhibitions are shown in parades or processions, picture P-19a
 Floating (swimming) S-471
 Floating bodies, law of (principle of Archimedes) A-303, L-262, diagram L-263, picture A-76
 Floating dry dock, pictures H-264, N-93
 Floating factory, of whaling ship W-114, picture W-112
 Floating plants W-67
 Floating ribs, in human skeleton, two lowest pairs of ribs which are attached only to the vertebrae
 Floe (*flo*), in water purification W-72
 Flocculi (*flocculi*), clouds around the sun S-452
 Flock papers, wallpaper W-4
 Flodden, or Flodden Field, in Northumberland, England, near Scottish border, September 1513: English under earl of Surrey defeated and killed James IV of Scotland; Sir Walter Scott's 'Marmion' gives account of the battle
 Floetie, Richard (born 1901), American artist and illustrator, born Essen, Germany, traveled in Germany, Italy, Netherlands, and Switzerland then made home in Orange County, N. Y. His prints have been added to collections in Metropolitan Museum of Art and the New York Public Library. For children he has illustrated 'Pinocchio', by Carlo Lorenzini, 'The Glorious Adventures of Tyl Uenspiegel', by Charles de Coster; 'Ballet Shoes', by Noel Streatfeild, and other titles in the 'Shoes' series.
 Flood, Henry (1732-91), Irish orator and political leader; witty, cultured; member Irish House of Commons 1759-83, British House 1783-90.
 Flood, excessive supply of water in river or lake sufficient to cause overflow F-143-6, pictures F-143-6. See also in Index Flood control and prevention
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 Floor leaders, in Congress of the United States C-435a
 Flora, Roman goddess of flowers and spring identified in late Roman mythology with the Greek goddess Chloris the wife of Zephyrus statue picture E-444
 Flora, all the plants of a region or of a division of geologic time
 Floral Park, N. Y., village about 15 mi. e. of New York City; pop. 14,562 map, inset N-204
 Flora Macdonald College, at Red Springs, N. C.: Presbyterian; for women, founded 1896, liberal arts.
 Florence, Ala., city in n.w. on Tennessee River, pop. 23,879; textiles, ceramic tile meat products; State Teachers College maps A-126, U-253
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 Florence, S.C., city in n.e., 97 mi. n.e. of Charleston; pop. 22,513; railroad shops; clothing, lumber products and furniture; state industrial school for boys; state agricultural experiment station: S-284, maps S-291, U-253
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 Flores (*flo-rĕs*), island of Indonesia s. of Celebes; over 5500 sq. mi.; pop. 491,851, mostly Papuan savages; exports copra, sandalwood, rubber: maps E-202, A-407
 Flores, westernmost island of Azores; 57 sq. mi.; pop. 7845
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 Flores Sea, between Flores and Celebes islands in Indonesia, maps E-202, A-407
 Florey, Sir Howard Walter (born 1898), British scientist, codiscoverer of penicillin, born Australia; professor of pathology, Oxford University, after 1935; shared 1945 Nobel prize in medicine and physiology: A-267
 Florian (*flo-rĕn-tĕs*), Jean Pierre Clarie de (1735-94), French author of fables, romances, and plays; his fables are part of every French school child's education.
 Florinopolis Bridge, in Brazil. See in Index Bridge, table
 Floriculture, flower gardening G-12-18
 Florida, a gulf state of U.S.; 58,560 sq. mi.; pop. 2,771,305; cap. Tallahassee: F-149-65, maps F-158-9, 151, 155, U-253, 277, pictures F-149-50, 152, 161-4
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Key: cāpe, āt, fār, fāst, what, fāll; m̄, yet, fĕrn, thĕre; ice, bīt; rōw, wōn, fōr, nōt, do; cĭre, bāt, rĭde, fĭll, bārn; out;

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topaz M-266
Fluorite. See in *Index* Fluorspar
Fluoroscope X-330, *picture* X-329
Fluorspar, or **fluorite**, a calcium fluoride (CaF₂), source of hydrofluoric acid; used as flux in steel making, in electrolytic production of aluminum, and as an ingredient in certain ceramic processes
fluorescent property L-235
mineral form M-265, *color picture* M-263
relative hardness M-261
sources in United States I-28
Flush, of tea plant T-29
Flushing, L. I., part of borough of Queens, New York City, on Long Island, about 10 mi. e. of Brooklyn; airplanes, thread, rubber, silk animal holding station Z-358
Flushing, Netherlands, also *Vlissingen* (vlis'ing-ën), fortified port in s.w. on island of Walcheren; pop. 20,217; formerly naval station; shipbuilding, iron and steel works; its guns command mouth of Scheldt River.
Flute, a musical instrument W-189, M-472, *picture* M-471
range of, *diagram* M-468b
tone S-238
Fluting. See in *Index* Architecture, *table* of terms
Flux, a substance which promotes the fusing of metals or ores
borax B-252
limestone, in smelting Iron I-239, 244
welding W-90
Fluxions, Newton's name for calculus X-193
Fly, a two-winged insect of the order Diptera F-188-9, *pictures* F-188-9. See also in *Index* names of individual insects called "flies," such as Dragonfly, etc.
enemies: flycatchers F-190, *pictures* F-190; swallow S-458; swift S-458; wasp W-50-3
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housefly F-188-9, *pictures* F-188-9. See also in *Index* Housefly
tsetse T-202-3, *picture* T-203
Fly, artificial, used in fishing F-118c, *pictures* F-118d
Fly *umunita*. See in *Index* Amanita
Fly ash, unburned, powdery products of combustion; formerly a waste product carried out with smoke through smokestacks; now, in many industrial areas, collected by electrical precipitators; used in concrete and other building materials. See also in *Index* Cottrell precipitator
Flycatchers, a family of birds F-190, *pictures* F-190, *color picture* B-169
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Flying boat. See in *Index* Seaplane
Flying buttress, in architecture A-316, 317, *pictures* A-315, E-440
Flying Cross, Distinguished, U. S., *color picture* D-41
Flying dragon. See in *Index* Flying lizard

Flying Ditchman, a legendary Dutch sea captain, doomed for a rash oath or as punishment for crime to beat about the Cape of Good Hope till Judgment Day; name also applied to the phantom ship in which he sailed the master of the ship was variously known as Captain Van Straaten and Vanderdecken; subject of opera by Wagner.
Flying Ditchman, a game G-8b
Flying fish F-191, F-102, *picture* F-191
Flying fox, or **fox bat** B-78
Flying lemur, cat-sized mammal that lives in trees of Malay region and feeds on fruit and leaves; folds of skin connecting head, limbs, and tail form a broad parachute that supports it in long glides from tree to tree; sole member of order Dermoptera ("skin-winged").
Flying lizard, or **flying dragon**, a lizard of Malaya L-284, D-126, *picture* L-283
Flying reptiles, prehistoric R-113, *pictures* R-111, 113
"Flying saucers," officially known in U. S. as unidentified flying objects; first reported 1944; color typically metallic silver in daytime, lights of different colors reported at night; shaped like disk, rocket, or cigar; name originated 1947 when Ken Arnold, pilot, described one as saucerlike; sightings reported all over world; seen singly and in formation; investigations made by various governments. Most "flying saucers" explained as temperature inversions, weather balloons, birds, the planet Venus, and other natural phenomena, but certain observers believe some to be interplanetary aircraft, the contention being supported by simultaneous radar and visual sightings of apparently controlled machines with a flight performance unmatched by any known aircraft.
Flying squid, or **sea arrow** O-338
Flying squirrel S-359b, *pictures* S-359a
Flying Tigers, name given to American Volunteer Group of fighter airplane pilots, under Brig. Gen. Claire L. Chennault, in Burma and s.e. China in World War II; group disbanded July 1942; most members inducted into the United States Air Forces.
Flying wing, airplane A-106, *picture* A-105
Fly mushroom. See in *Index* Amanita
Fly River, in Territory of Papua, New Guinea; rises near w. border and flows s.e., entering Gulf of Papua through wide estuary; navigable for about 500 of its 800 mi.; N-141, *maps* E-203, F-16
Flyweight, in boxing B-267
Flywheel, a heavy wheel whose weight resists sudden changes of speed, thus insuring uniform motion
principle of construction C-178
FM. See in *Index* Frequency modulation
FNMA. See in *Index* Federal National Mortgage Association
FOA (Foreign Operations Administration), U. S. U-395, U-368
Foal, a young horse H-428, 428i
Foam glass G-122b
Focal length, of lenses L-167-8, *diagram* L-166
camera lens P-222
Focal plane, of camera L-168
human eye compared to E-459
Focal plane shutter, camera P-222
Foeb (fósh), Ferdinand (1651-1929), French general and marshal of France, commander in chief of Al-

lied armies, World War I F-191
assumes Allied command W-228
leads offensive of 1918 W-230
presents terms of armistice W-232
Focke (fók'é), Heinrich (born 1890), German airplane designer
helicopter A-541
Focus, of lens L-167-9, *diagram* L-166
camera P-212-13, 223
eye E-459, *diagram* L-168
Fodder, coarse feed, such as hay, vegetables, given to livestock. See also in *Index* Forage crops
Föhn, or **föhn** (fün), warm dry wind particularly that in valleys n. of Alps, also in Norway and Greenland; called chinook in the United States: W-150, 153
Foerster (für'stér), Norman (born 1887), educator and critic, born Pittsburgh, Pa.; director, School of Letters, University of Iowa 1930-44, continued classical, conservative humanist movement of Irving Babbitt and Paul Elmer More ("American Criticism"; "Toward Standards"; editor, "Humanism and America").
Fog F-192, C-359
cause of F-192; Gulf Stream O-336; Labrador Current F-192
colloidal nature C-385
dispersing by fire, *pictures* F-192
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Fognazzaro (fō-gāt-sā'rō), Antonio (1842-1911), Italian writer, born Vicenza I-260
Fogg Art Museum, Cambridge, Mass. See in *Index* Museums, *table*
Durer's "The Lamentation" D-140a, *picture* D-140b
Tiepolo's "The Rest on the Flight into Egypt" D-138, *picture* D-138
Foggia (fōd'gā), city in e. Italy; pop. 57,234; market for agricultural produce of great Apulian plain; the emperor Frederick II often a resident: *maps* I-262, E-425
Foggini (fōd-jē'nē), Giovanni Battista (1632-1725), Italian sculptor; follower of Bernini; did memorial to Galileo in church of Santa Croce, Florence.
Fogo, one of Cape Verde Islands; about 200 sq. mi.; pop. 16,705; of volcanic origin; volcano 9,281 ft., highest point of islands: *map, inset* A-47
Föhn. See in *Index* Föhn
Foil, a light sword used in fencing F-51, *pictures* F-51, S-484
Foil, or **leaf**, term applied to thin pliable sheets of metal
aluminum A-182
gold G-133-4
silver S-188
Folk (fók), Gaston de, duke of Nemours (1489-1512), French general battle of Ravenna R-79
Folk, French province, *map* F-270
Fokine (fō-kē'nē), Michel (1860-1942), ballet dancer and choreographer, born St. Petersburg (Leningrad), Russia; called "the father of contemporary ballet"; was choreographic director of Diaghilev's Russian ballet; wife, Vera Fokina (born 1886), also a Russian dancer: B-28a, D-14j, 1, *picture* D-14i
Fokker, Anthony Herman Gerard (1890-1939) Dutch airplane builder, born Java; inventor of Fokker plane used by Germans in World War I; inventions include synchronizing gear, making it possible to shoot through revolving propeller blades; founded, with others, Fokker Aircraft Corp., Glendale, W. Va.
Folding, in geology G-54-6, E-186, M-439, *diagrams* E-189
Folding machine, bookbinding, *picture* B-244

Key: cdp, dt, fār, fāst, what, fāll; mē, yēt, fērn, thäre; fce, bīt; rōw, wōn, fōr, nōt, āq; cāre, bāt, rjde, full, bārn; out;

NATIONAL FOOTBALL LEAGUE CHAMPIONS*

1921	Chicago Bears	1938	New York Giants
1922	Canton	1939	Green Bay
1923	Canton	1940	Chicago Bears
1924	Cleveland	1941	Chicago Bears
1925	Chicago Cardinals	1942	Washington
1926	Frankford (Phila.)	1943	Chicago Bears
1927	New York Giants	1944	Green Bay
1928	Providence	1945	Cleveland Rams
1929	Green Bay	1946	Chicago Bears
1930	Green Bay	1947	Chicago Cardinals
1931	Green Bay	1948	Philadelphia
1932	Chicago Bears	1949	Philadelphia
1933	Chicago Bears	1950	Cleveland Browns
1934	New York Giants	1951	Los Angeles
1935	Detroit	1952	Detroit
1936	Green Bay	1953	Detroit
1937	Washington	1954	Cleveland Browns

*Beginning 1933 championship decided by play off between division leaders.

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 pure food laws P-442-3
 salting S-31
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 Food Research Institute, established 1921 at Stanford University, Palo Alto, Calif.: objective to "promote understanding of food production, distribution, and consumption."
 Food substitutes
 coffee C-379
 oleomargarine O-377-8
 pure food laws P-442-3
 vanilla V-439
 vinegar V-474
 Fool hen, grouse G-221
 Foods, Feast of, festival popular in Europe in Middle Ages, in which the clergy and religious ritual were mimicked; donkey usually had a part in the grotesque celebration.
 Foods Court. See in Index Jesters Court
 Food's gold, or iron pyrites M-262
 a source of sulfur S-447
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 Foot and mouth disease, sometimes called hoof and mouth disease, an infectious disease, particularly of cattle and hogs C-147
 vaccine inoculation, picture V-433a
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 Foot-blinding, in China C-266, pictures C-263, S-162
 Foot-candle, unit of light measurement L-220
 Foote, Andrew Hull (1806-63), rear admiral, born New Haven, Conn.; commanded western flotilla in the Civil War, and captured Ft. Henry and Island No. 10: C-335
 Foote, Arthur (1853-1937), composer, pianist, and organist; born Salem, Mass.; for orchestra ('In the Mountains'); settings for poems ('The Skeleton in Armor', 'Farewell to Hiawatha'); church music; songs.
 Foote, Mary Jillock (1847-1938), illustrator and novelist, born Milton, N.Y. ('The Led-Horse Claim'; 'The Valley Road').
 Footings. See in Index Architecture, table of terms
 Footless fishes, order Apodes, including eels E-268
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 oats O-322
 oil cake from cotton, flax, and other seeds F-45
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 sorghum S-236, picture S-236
 soybeans S-308b
 turnips C-1
 vetch V-466
 Forage fish, list F-118h
 Fornin (Jó-rönn'), Jean Louis (1852-1931), French painter and etcher; witty caricatures of Paris life.
 Foraker, Mount, in Mount McKinley National Park N-37
 Foraker Act (1900), act of Congress

Key: cápe, át, fár, fóst, what, fall; mé, yét, fèrn, thère; íce, bit; rów, won, fôr, nót, dq; cûre, bú, rýde, fúll, bûrn; out;

AREAS OF NATIONAL AND STATE FORESTS* IN THE UNITED STATES AND POSSESSIONS

STATE	NATIONAL FORESTS (ACRES)	STATE FORESTS (ACRES)	STATE	NATIONAL FORESTS (ACRES)	STATE FORESTS (ACRES)
Alabama	1,751,296	9,480	Nebraska	207,209	-
Alaska	20,777,294	-	Nevada	5,376,572	-
Arizona	12,106,492	-	New Hampshire	798,291	60,445
Arkansas	3,395,058	-	New Jersey	-	60,370
California	24,202,112	70,237	New Mexico	9,912,011	-
Colorado	15,182,908	70,821	New York	-	2,971,016
Connecticut	-	121,556	North Carolina	2,821,240	36,000
Delaware	-	4,704	North Dakota	-	-
Florida	1,241,956	192,400	Ohio	-	146,326
Georgia	1,518,322	39,656	Oklahoma	291,509	-
Hawaii	-	1,210,156	Oregon	1,737,163	710,027
Idaho	21,553,362	806,686	Pennsylvania	721,697	1,784,488
Illinois	812,654	10,078	Puerto Rico	65,930	-
Indiana	781,467	109,977	Rhode Island	-	13,384
Iowa	-	13,504	South Carolina	1,423,339	123,502
Kansas	-	-	South Dakota	1,493,357	123,000
Kentucky	1,357,685	30,383	Tennessee	1,204,102	143,752
Louisiana	877,065	8,000	Texas	1,716,964	6,632
Maine	53,551	-	Utah	8,917,842	-
Maryland	-	118,107	Vermont	629,004	75,009
Massachusetts	-	170,099	Virginia	3,909,657	42,415
Michigan	3,023,562	3,356,550	Washington	10,744,529	1,750,000
Minnesota	4,186,042	5,344,206	West Virginia	820,217	97,194
Mississippi	2,432,093	24,760	Wisconsin	2,019,678	271,473
Missouri	3,321,513	151,822	Wyoming	9,016,134	-
Montana	19,012,891	543,090	Total	220,092,278	21,007,016

*Only state forests; acreage specifically designated as state forest.

Fore-edge painting, in bookmaking B-240

Forefathers' Day (December 21) F-57

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Foreign and Domestic Commerce, Bureau of, U. S. U-366

Foreign Assistance Act of 1948, U. S. T-200, I-197

Foreign body, in eye, ear, or stomach first aid F-98

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Foreigner, in U. S. See in Index Alien; Immigration, subhead United States

Foreign exchange F-235

gold standard affects F-235

International Monetary Fund U-243

international trade payments I-194-5

operation and control I-196-7

World War I affects F-235

Foreign Legion, French military force made up mainly of adventurers from all over the world; created by Louis Philippe in 1831; military and construction service in many parts of the world; subject to the strictest military discipline; high reputation for valor

first regiment A-166

Foreign missions C-303-4. See also in Index Missions, Christian

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Foreign trade T-164-6, I-191-7, pictures I-195, 197, table I-193. See also in Index International trade; Trade; and subhead commerce under names of countries

Census Bureau reports C-170 meaning and value I-192

Foreign trade zones. See in Index Free ports

Foreign-Trade Zones Board, U. S. U-366

Foreign Wars of the U. S., Military Order of, patriotic and military organization founded 1894; membership limited to commissioned officers of U. S. Army who have

served in wars against foreign powers; purpose, national defense against foreign aggression

Forelock, of horse, picture H-4280

Foreman, spokesman for a jury J-385

Forestar, of a sailboat B-216

Forest cantons, of Switzerland S-462

Forester, Cecil Scott (born 1899), English journalist; and novelist, born Cairo, Egypt; noted for 'Payment Deferred', a murder story, and a series of novels on Horatio Hornblower, a naval officer of the Napoleonic period.

Foresters, Orders of, fraternal, beneficent, and benevolent orders first founded in England; written history dates from 1790 when order was known as Ancient Royal Order of Foresters; later superseded by Ancient Order of Foresters; introduced into America, 1832; Independent Order of Foresters founded at Newark, N.J., 1874, by seceding bodies; Ancient Order of Foresters of America founded 1859 by further seceders (name changed to Foresters of America 1895).

Forest Park, Ill., residential suburb of Chicago about 2 mi. w.; pop. 14,969; once called Hariem: map, inset I-36

Forest Park, in St. Louis, Mo. S-22

Forest Pest Control Act, U. S. F-239

Forest products. See also in Index Camphor; Charcoal; Lumber; Rubber; Tannin; Wood

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Forest reserves. See in Index Forests and forestry, subheads national forests, state forests; National parks and monuments; also the Fact Summary in each state article

Forestry. See in Index Forests and forestry

Forestry Association, American. See in Index American Forestry Association

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Fort Myers, Fla., city in s. w. on Caloosahatchee River, 15 mi. from coast; pop. 13,195; fort built here in 1839 to check Seminole Indians; western terminus of Cross-State

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Fort Necessity, stockade erected in 1754 on the Great Meadows, a level area 9 mi. s.e. of present Uniontown, s.w. Pennsylvania; fort surrendered by Major George Washington and his colonial troops

July 3, 1754, in early battle of French and Indian War; in 1931 made national battlefield site (2 acres); map P-132

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Fort Niagara, old fort at mouth of Niagara River, N. Y., overlooking Lake Ontario; strategic position at head of Great Lakes; first fort here built by La Salle in 1678, rebuilt by French in 1725 and 1756; captured by British in French and Indian War, 1759; surrendered to U. S. in 1796; recaptured by British in 1813, restored to U. S. in 1815 by Treaty of Ghent; rebuilt in 1934; use as fort discontinued Feb. 1946.

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 Fouché (*fô-shâ*'), Joseph, duke of Otranto (1763-1820), French revolutionist and statesman; twice minister of police; active in suppressing Robespierre; head of provisional government after the battle of Waterloo.
 Fōjōtō (*fô-jô-tô*), Tsōgōhōrōn (born 1886), Japanese painter and lithographer; moved to Paris, France 1913; still lifes, landscapes, portraits, and animals, particularly cats.
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 Fouquet (*fô-kê*'), Jean, or Jehon (1420?-60?), French artist, court painter to Charles VII and Louis XI; superb illuminator and miniaturist, also historical painter.
 Fouquet, Nicolas (1615-80), superintendent of finance, and procureur-général under Louis XIV; patron of arts; amassed great fortune and power; put in prison for life 1664.
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 Fourier, Jean Baptiste Joseph (1768-1830), French mathematician; accompanied Napoleon to Egypt; made governor of Lower Egypt; chief work in theory of heat and of numerical equations; Fourier series, important in mathematical physics.
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 Fox, John, Jr. (1863-1919), novelist, born Bourbon County, Ky.; wrote 'Little Shepherd of Kingdom Come', 'Trail of the Lonesome Pine', and other stories of the Cumberland Mountains.
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 rococo period whose gay delicate
 paintings exvieve the frivolous lux
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 Jacques Anatole Thibault (1860-
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 critic most distinguished modern
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RULERS OF FRANCE

CAROLINGIAN LINE
 761-763 Pepin the Short
 768-814 Charlemagne
 814-840 Louis I, the Pious
 843-877 Charles I, the Bald
 877-879 Louis II
 879-882 Louis III
 879-884 Carloman
 884-887 Charles II, the Fat
 [888-898 Odo of Anjou]
 893-922 Charles III, the Simple
 [922-923 Robert I of Anjou]
 [923-936 Rudolph of Burgundy]
 936-954 Louis IV
 954-966 Lothar
 966-987 Louis V

CAPETIAN LINE
 987-996 Hugh Capet
 996-1031 Robert I
 1031-1060 Henry I
 1060-1103 Philip I
 1103-1137 Louis VI, the Fat
 1137-1180 Louis VII
 1180-1223 Philip II, Augustus
 1223-1226 Louis VIII
 1226-1230 Louis IX, the Saint
 1230-1235 Philip III
 1235-1314 Philip IV
 1314-1316 Louis X
 1316-1322 Philip V
 1322-1328 Charles IV

VALOIS LINE
 1328-1350 Philip VI
 1350-1364 John II

1364-1380 Charles V
 1380-1422 Charles VI
 1422-1461 Charles VII
 1461-1483 Louis XI
 1483-1493 Charles VIII
 1493-1515 Louis XII
 1515-1547 Francis I
 1547-1559 Henry II
 1559-1569 Francis II
 1569-1574 Charles IX
 1574-1589 Henry III

BOURBON LINE

1589-1610 Henry IV
 1610-1643 Louis XIII
 1643-1715 Louis XIV
 1715-1773 Louis XV
 1774-1792 Louis XVI
 [1792-1799 First Republic]
 [1799-1804 Napoleon Bonaparte
 First Consul]

THE FIRST EMPIRE

1804-1815 Napoleon I, Emperor

THE BOURBON RESTORATION

1814-1824 Louis XVIII
 1824-1830 Charles X
 1830-1838 Louis Philippe
 [1848-1852 Second Republic]

THE SECOND EMPIRE

1852-1870 Louis Napoleon reclaims
 as Napoleon III
 [1871 Third Republic established]

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occupation of West Germany and
Austria ends E 439

Francr Maled of Sea in Index Jean
of Arc

France Mlea Sea in Index Horwith
Francis R

Francesca (frān chēka kō) Piero della
or Franceschi Piero de (1418-
93) Italian painter of the Um
brian school also a mathematician
painted by geometrical principles
a great realist and master in
perspective wrote on subjects of
geometry and art

Francesca da Rimini (frān chēka kō
dā rē-mē-nō) (died 1288?) wife of
Malatesta of Rimini who having
fallen in love with her husband's
brother was killed by her husband
story told in Dante's Inferno

Franceschini (frān chē kē-tē) Zina
(born 1905) French violinist
born Marseilles France began
study of violin with parents at 3
made world wide tours

Franché-Comté (frān chē kō-tē) old
provinces in a France in Rhone
basin, now departments of Doubs
Haute Saône Jura and part of
Ain conquered by Louis XIV in
1674 map F 270

held by dukes of Burgundy C 165

Franchet d'Espèrey (frān chē kō
dē-pē-rē) Louis (1856-1912) French
general created marshal of France
in 1921 commanded 8th Army in
first battle of Marne commander in
chief at Salonika in 1918 overcame
Bulgaria

Franchetti (frān chē-tē) Albert Baron
(1860-1918) Italian opera conduc
tor also composer of operas cham
ber music and a symphony

Franchet a special privilege or ex
emption granted to public utility
companies F 439

franc in H 275

Franchise constitutional or political
right of suffrage See in Index
Suffrage

Francin (frān chā) real name Fran
cesco Halbolini (1650-1618) Italian
painter and goldsmith greatest of
early Bolognese school Raphael
influence dominates his painting

Francis José Gaspar Rodríguez
(1737?-1840) dictator of Paraguay
1814-40 austere gloomy ruthless
despot whose very name Paragua
yans dared not pronounce (he was
E Supremo during life and El
Difunto when dead) and who for
36 years kept Paraguay a hermit
nation knowing neither war nor
will of its own described by
Carlyle and by Edward L White
(El Supremo) F 76

Francis I (1708-55) Holy Roman
emperor husband of Maria Theresa
F 275 A 498

Maria Theresa M 85

Francis II (1768-1835) Holy Roman
emperor later as emperor of Aus

trich called himself Francis I

F 276 A 498

Napoleon marries daughter N 8

Francis I (1494-1547) king of France

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Francis LXXXXIX of France LXXXXIX 474

Francis LXXXXX of France LXXXXX 474

man bishop of Geneva his book
introduction to the Devout Life
has been translated into almost
every language patron of Journal
de la spiritualité January 29

Francolin names for birds of the
genus *Francolinus* allied to par
tridges richly colored plumage
about 50 forms inhabit Asia and
Africa game birds good for food

Franculus (land of the Franks)
medieval German duchy chiefly
of Rhine in valley of Main G 98

Francusian line or Salian line of Ger
man emperors or Salians line of Ger
man Empire table of rulers

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Francusian Naleh N H N 143 pic
tures N 143 145

- Elbe and Vistula; fairs: maps G-88, E-424
- Frankfurter, Felix** (born 1882), American jurist and educator, born Vienna, Austria; Harvard University law professor 1914-38; appointed associate justice U. S. Supreme Court 1939 ('The Public and Its Government').
- Frankincense**, a fragrant gum resin from certain trees of the genus *Boswellia* found in East Africa, Arabia, China, India, etc.; also called olibanum; used as incense; name also given to other tree gums.
- Franking privilege**, for mail P-388
- Frankland, Sir Edward** (1825-99), English chemist and physicist, formulator of the doctrine of chemical valency and discoverer (with Lockyer) of helium.
- Frankland, State of.** See in Index Franklin, State of
- Franklin, Benjamin** (1706-90), American scientist and statesman F-279-81, pictures F-279, 280, 280a, b, R-130
- Albany Congress R-120-1, A-139
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- 'Autobiography' L-186
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- Poor Richard's Almanack** F-280a, R-89, A-226, picture R-89j
- portrait on \$100 bill, table M-339
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- Richard Saunders, pen name F-280a
- Stamp Act S-367, F-280b
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- Franklin, Edward Curtis** (1862-1937), chemist, born Geary City, Kan.; professor Stanford University 1906-29; chief of division of chemistry, U. S. Public Health Service, 1911-13; chemist, Bureau of Standards, 1918; researches on liquid ammonia as an electrolytic solvent.
- Franklin, Sir John** (1786-1847), British admiral and Arctic explorer P-350
- route of ships, map P-346
- Franklin, Miles** (born 1883), Australian writer, born New South Wales, Australia; her books have strong Australian flavor (novel, 'All That Swagger'; with Kate Baker wrote biography, 'Joseph Furphy'). See also in Index Brent of Bin Bin
- Franklin, William Suddards** (1863-1930), physicist and electrical engineer, brother of Edward Curtis; born Geary City, Kan.; professor of physics at Iowa State College, Lehigh University, and Massachusetts Institute of Technology.
- Franklin, N. H.**, city 17 mi. n. of Concord; pop. 6552; paper, textiles, and hosiery mills; machinery; Daniel Webster born here in a section which was then in Salisbury township: map N-151
- Franklin, Pa.**, city on Allegheny River 9 mi. s.w. of Oil City; pop. 10,006; oil and natural gas, lumber, engines, tools: map P-132
- Franklin, battle of**, in American Civil War: Federals under Schofield defeated Confederates under Hood near Franklin, town 17 mi. s. of Nashville (Nov. 30, 1864); one of bloodiest of the war: map C-334
- Franklin, District of, Canada**, in n. part of Northwest Territories about 554,032 sq. mi. N-298, map C-68-9
- Franklin, State of, or Frankland** (later Tennessee) T-59
- Sevier governor S-108
- Franklin and Marshall College**, at Lancaster, Pa., Evangelical and Reformed church; for men, formed 1850 by union of Franklin College (founded 1787) and Marshall College (founded 1836); arts and sciences
- Franklin College of Indiana**, at Franklin, Ind.; established by Baptists in 1834 but now nonsectarian; liberal arts
- 'Franklin D. Roosevelt', airplane carrier N-83, pictures N-80, 83
- Franklin D. Roosevelt Lake**, in n.e. Washington, at Grand Coulee Dam C-415b, map W-45
- Franklin Foundation** F-248-9
- Franklin Institute** (of the State of Pennsylvania for the Promotion of Mechanical Arts), in Philadelphia, Pa., society established in 1824; particularly interested in the application of science to industry; holds scientific and popular lectures; conducts schools in mechanical subjects; grants medals and certificates for outstanding inventions: picture P-188. See also in Index Museums, table
- aid from Franklin bequest F-248-9
- Franklinite**, an oxide of iron, zinc, and manganese; occurring as brittle blue or black crystals; valuable as ore of iron and zinc: Z-351, P-40
- Franklin Lake**, in n.e. Nevada; 35 mi. s.e. of Elko; area about 32 sq. mi.; federal game refuge: map N-132
- Franklin's grouse** G-221
- Franklin's gull** G-230, picture G-231
- Franklin's Tale**, in Chaucer's 'Canterbury Tales' C-204
- Franklin store** S-424, F-280a, picture A-216
- Franklin Technical Institute** (until 1941 Franklin Union), Boston, Mass.; industrial and technical institute; opened 1908; established by Boston with money left by Benjamin Franklin and endowed by Andrew Carnegie and James W. Storrow: F-248-9
- Frank's**, warlike Germanic tribes that first settled along lower Rhine River as early as 3d century A.D.; kingdom finally included greater portion of w. Germany and territory which now forms Belgium, France, and Netherlands: M-237, F-268
- Belgium B-115**
- Charlemagne rules C-186-8
- Charles Martel defeats Saracens C-196
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- invade Gaul E-431, 432
- partition of Verdun (843) E-432, V-451
- repeal Vandals V-437
- repeal Visigoths G-143
- Franz (fränts)**, Robert (1815-92), German composer; was director of music at University of Halle, but forced to give up because of deafness; best songs distinguished for tenderness and beauty, rank next to those of Schubert and Schumann.
- Franzen (fränt-sän')**, Frans Michael (1772-1817), Swedish writer, clergyman, and educator, born Finland; religious songs and biography.
- Franz Josef Land**, Russia. See in Index Fridtjof Nansen Land
- Franz Joseph Gfeller**, New Zealand, picture G-115
- Frasch (fräsh)**, Herman (1851?-1914), American chemist and inventor, born Germany; important inventions in connection with petroleum products and oil refining improves sulfur mining S-447
- Fraser, James Earle** (1876-1953), sculptor, born Winona, Minn., ('End of the Trail', a memorial to the North American Indian; busts of Theodore Roosevelt and Augustus Saint-Gaudens; Lincoln statue at Jersey City; John Ericsson Monument, Washington, D.C.; design for Buffalo nickel). His wife, Laura Gardin Fraser (born 1889), also a sculptor of note.
- Fraser, Simon** (1776-1862), explorer of Fraser River, British Columbia, Canada (1808); leader of North West Company: B-316, F-324
- Fraser River**, Canada, chief river of British Columbia; two forks unite near Fort George, flowing s. 740 mi. into Strait of Georgia; gold deposits: B-313, maps C-68, 80, pictures D-314
- salmon fisheries B-314
- Fraserville**, Quebec, Canada. See in Index Rivière du Loup
- Fraternities and sororities**, college U-402. For list, see table on next page
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- Fraunhofer lines** (from 'hü-fer'), Joseph von (1787-1826), German optician and physicist
- spectrum and spectroscopy S-331, 332
- telescope T-47
- Fraunhofer lines** S-331, 332, P-231
- Frazer, John** (1790-1852), stone carver and sculptor, born Rahway, N.J.; portrait busts of Daniel Webster and other noted contemporaries; said to have carved first marble bust in America by a native American.
- Froyer, Sir James George** (1854-1941), British anthropologist and classical scholar, born Glasgow, Scotland; most famous work is 'The Golden Bough' in 12 volumes, a comparative survey of primitive religions of the world; also wrote 'The Worship of Nature' and other books on myths and magic; translated classical works, including 'Fasti' of Ovid and works of Pausanias.
- Frozier, Edward Franklin** (born 1894), sociologist and writer, born Baltimore, Md.; professor and head of Sociology Department Howard University, Washington, D. C., after 1934 ('The Negro in the United States').
- Frazil'** lee I-3

Key: cöpe, ät, fär, föst, what, fäll; mä, yät, fërn, thäre; ice, hüt; röw, wön, fôr, nôt, dâ; cûre, büt, rûde, füll, bûrn; out;

GENERAL COLLEGE FRATERNITIES

FOUNDED	FRATERNITY	WHERE FOUNDED	FOUNDED	FRATERNITY	WHERE FOUNDED
1904	Aencia	University of Michigan	1899	Phi Kappa	Brown University
1895	Alpha Chi Rho	Trinity College, Hartford, Conn.	1892	Phi Kappa Psi	Jefferson College
1832	Alpha Delta Phi	Hampden College	1850	Phi Kappa Psi	University of Pennsylvania
1913	Alpha Epsilon Phi	New York University	1906	Phi Kappa Psi	St. Ann's University
1904	Alpha Epsilon Rho	Ohio State University	1918	Phi Mu Delta	Wesleyan University, Middlebury, Conn.
1914	Alpha Kappa Lambda	University of California	1915	Phi Psi	Cherry
1901	Alpha Kappa Psi	Newark College of Engineering	1910	Phi Sigma Delta	Columbia University
1914	Alpha Lambda Tau	Oglethorpe University	1873	Phi Sigma Kappa	Masachusetts Agricultural College
1914	Alpha Mu Sigma	Cooper Union Institute of Technology	1868	Phi Kappa Alpha	University of Virginia
1912	Alpha Phi Delta	Syracuse University	1904	Phi Kappa Psi	College of Charleston
1845	Alpha Sigma Phi	Yale University	1895	Phi Lambda Phi	Yale University
1865	Alpha Tau Omega	Richmond, Va.	1833	Phi Upsilon	Union College
1901	Beta Kappa	Hampden University	1856	Sigma Alpha Epsilon	University of Alabama
1839	Beta Theta Phi	Massachusetts University	1909	Sigma Alpha Mu	College of the City of New York
1854	Chi Phi	University of Virginia	1855	Sigma Chi	Massachusetts University
1841	Chi Psi	University of Virginia	1921	Sigma Delta Rho	Trinity College
1890	Delta Chi	Cornell University	1921	Sigma Mu Sigma	Virginia Military Institute
1844	Delta Kappa Epsilon	Yale University	1869	Sigma Nu	Union College
1827	Delta Phi	University of California	1821	Sigma Phi	University of Richmond
1847	Delta Psi	Columbia University	1901	Sigma Phi Epsilon	University of Pennsylvania
1899	Delta Sigma Phi	College of the City of New York	1908	Sigma Phi Sigma	University of Pennsylvania
1859	Delta Tau Delta	Jefferson College	1897	Sigma Psi	University of Pennsylvania
1834	Delta Upsilon	Wellesley College	1910	Sigma Tau Phi	College of the City of New York
1875	Kappa Alpha	Union College	1918	Tau Epsilon Phi	Columbia University
1863	Kappa Alpha (South Kern Order)	Washington and Lee University	1899	Tau Kappa Epsilon	University of Virginia
1905	Kappa Delta Rho	University of California	1856	Theta Chi	Norwich University
1911	Kappa Nu	University of Rochester	1847	Theta Delta Chi	Lehigh University
1860	Kappa Sigma	University of Virginia	1919	Theta Kappa Phi	Wesleyan University, Middlebury, Conn.
1909	Lambda Chi Alpha	Boston University	1870	Theta Nu Epsilon	Hampden College
1912	Omega Alpha Tau	Cornell University	1864	Theta X	University of Illinois
1914	Phi Alpha	Columbia University	1907	Tau Alpha	New York University
1912	Phi Beta Delta	Columbia University	1890	Zeta Beta Tau	New York University
1848	Phi Delta Theta	College of the City of New York	1847	Zeta Phi	New York University
1904	Phi Epsilon Lambda	Jefferson College			
1844	Phi Gamma Delta	Jefferson College			

GENERAL COLLEGE SORORITIES

FOUNDED	SORORITY	WHERE FOUNDED	FOUNDED	SORORITY	WHERE FOUNDED
1885	Alpha Chi Omega	De Pauw University	1874	Gammas Beta Beta	Syracuse University
1851	Alpha Delta Psi	Wesleyan College, Macon, Ga.	1870	Kappa Alpha Theta	De Pauw University
1909	Alpha Epsilon Phi	Barnard College	1897	Kappa Delta	University of Illinois
1904	Alpha Gamma Delta	Syracuse University	1870	Kappa Kappa Gamma	Massachusetts College
1897	Alpha Omicron Pi	Barnard College	1919	Phi Delta	New York University
1878	Alpha Phi	Syracuse University	1852	Phi Mu	Wesleyan College, Macon, Ga.
1843	Alpha Xi Delta	Lombard College	1918	Phi Omega Psi	University of Nebraska
1909	Beta Beta Alpha	University of California	1847	Phi Rho Psi	Moscow College
1848	Beta Sigma Omicron	University of Missouri	1917	Sigma Delta Tau	Cornell University
1895	Chi Omega	University of Arkansas	1874	Sigma Kappa	Colby College
1888	Delta Delta Delta	Boston University	1912	Theta Phi Alpha	University of Michigan
1874	Delta Epsilon	Oxford University	1914	Theta Psi Chi	University of California
1917	Delta Phi Epsilon	New York University	1896	Zeta Tau Alpha	University of Illinois
1902	Delta Zeta	Massachusetts University			

Fr  chette (fr  sh  t) Louis Honor   (1829-1908) French Canadian poet, lyric inspired by patriotism, nature, friendship, family (Veronica, a tragedy, Papeau and Felix, Poutre, historical plays) C 108

Frederick Harold (1858-98) novelist, Boston, Uta, N.Y. Damnation of Theron Ware, intensive study of middle class America. The Copperhead, a story of the Civil War

Frederick I Barbarossa (1123-90) Holy Roman emperor, in many respects the ideal emperor of the Middle Ages P 251

charters University of Bologna U-404

leads Third Crusade C 520 F 251 opens Charlemagne's tomb A 1

Frederick II (1194-1250) Holy Roman emperor F 251

Fifth Crusade C 522

Frederick III (1415-93) Holy Roman emperor F 252 A 496

Frederick III (1609-70) king of Denmark, he transformed Denmark into an absolute monarchy and made crown hereditary, unsuccessful wars with Sweden 1657-63

Frederick IV (1671-1730) King of Denmark and Norway from 1699 C 193

Frederick VI (1764-1839) king of Denmark and Norway, succeeded 1808 (previously regent) joined Armed Neutrality of North and was punished (1801) by destruction of fleet by English (read him of fleet by English) suffered similarly for neutrality again in 1807 then allied with Napoleon and was compelled by Allies (1814) to surrender Norway to Sweden as punishment

Frederick VII (1808-85) king of Denmark, succeeded 1863, in his reign Schleswig-Holstein troubles arose, ripe for Bismarck's intervention in next reign

Frederick VIII (1843-1912) king of Denmark, succeeded father Christian IX, in 1908 father of Haakon VII of Norway, brother of King George I of Greece and of Queen Alexandra of England

Frederick IX (born 1893) king of Denmark, succeeded father Christian X, in 1947 first king of Denmark to be trained by national navy, his predecessors trained by army

Frederick I (1657-1718) first king of Prussia (1701) previously Frederick III, elector of Brandenburg (1688-

1701) and duke of Prussia, patron of learned men but vain, extravagant, won title of king for siding Leopold I in War of Spanish Succession

Frederick II (1712-86) king of Prussia F 252 picture F 252

Born in beautiful by B 128

literature in his reign C 84

method of warfare W 16

part of Poland A 498 P 344

Potdam C 193

Seven Years War S 107 A 492

War S 107

War of Austrian Succession A 497 S

Frederick III (1892-88) German emperor and king of Prussia (March 9 to June 15 1888) commanded at Sedan and siege of Paris in Franco-Prussian War, liberal cultured friend of parliamentarian government B 148

Frederick I the Victorious (1425-76) elector Palatine 1451-76 tried to dethrone Emperor Frederick III, great military leader

Frederick II the Wise (1482-1558) elector Palatine (succeeded 1544) commanded imperial army at siege

- of Vienna 1529; became Protestant through influence of Melancthon.
- Frederick III**, the Pious (1515-76), elector palatine (succeeded 1559); laid foundation for systematic Calvinism; aided French Huguenots.
- Frederick IV**, the Upright (1574-1610), elector palatine (succeeded 1583), championed Protestantism.
- Frederick V** (1596-1632), elector palatine and "winter king" of Bohemia; through his marriage with Elizabeth, daughter of James I of England, ancestor of the Windsor (Hanover) line of English kings; king of Bohemia 1619-20; exiled. *Thirty Years' War* T-118.
- Frederick III**, the Wise (1463-1525), elector and duke of Saxony, refused imperial throne 1619 and suggested election of Charles V, friend of Luther and Melancthon, whom he invited to teach at University of Wittenberg founded by him.
- Frederick Henry** (1584-1647), prince of Orange; youngest son of William the Silent and brother of Maurice of Nassau; ended the 80-year struggle with Spain by the treaty of Munster (1648), signed just after his death; his term as stadholder (1625-47) called golden age of Dutch Republic.
- Frederick William I** (1688-1740), king of Prussia; came to throne 1718; the real founder of modern Prussia; left Prussia world's third military power and on sound financial basis.
- trains **Frederick the Great** F-282.
- Frederick William II** (1744-97), king of Prussia, grandson of above; came to throne 1786; with Austria, supported Louis XVI in French Revolution.
- Brandenburg Gate** B-126.
- Frederick William III** (1770-1840), king of Prussia; came to throne 1797; good, weak man under whom Prussia was almost effaced by Napoleon, but restored by Congress of Vienna and rehabilitated by the great ministers Stein and Hardenberg; member of Holy Alliance; his queen Louise, a heroine of modern Germany; founder of University of Bonn (1818).
- beet sugar industry S-445.
- Frederick William IV** (1795-1861), king of Prussia; came to throne 1840; reactionary idealist; reluctantly granted Prussian constitution following revolutionary uprisings of 1848; insane in later years; brother (later William I), regent.
- Frederick William** (1620-88), the "great elector" of Brandenburg and duke of Prussia; succeeded 1640; laid foundation for greatness of Prussia, previously ruined by *Thirty Years' War* P-424a.
- Berlin improved by B-126.
- Frederick William** (1882-1951), crown prince of Prussia, renounced claim to throne in 1918; commander of Fifth German army in World War I second battle of the Aisne W-228-8.
- Verdun V-450-1, W-226.
- Frederick**, Md., city 44 ml. n.w. of Baltimore; pop. 18,142; clothing, electronic products, brushes, iron and steel, kitchen utensils; Camp Detrick, home of Chemical Corps Biological Research Laboratories; Hood College and state school for deaf; scene of Whittier's "Barbara Fretchle"; hurling place of Francis Scott Key; map M-116.
- Fredericksburg**, Va., city 60 ml. n. of Richmond, on Rappahannock River at head of tidewater; pop. 12,158; national and Confederate cemeteries; Mary Washington College of University of Virginia; strategic point in Civil War map V-487.
- Kenmore, home, picture A-193b.
- Fredericksburg**, battle of F-283, C-336, map C-335.
- Hancock at H-255.
- Fredericksburg and Spotsylvania County Battle Field** Memorial National Military Park, in Virginia; established 1927; Civil War battles.
- Fredericton**, New Brunswick, Canada, capital and railroad center on St. John River; pop. 16,018, shoes, boats, lumber, cotton; coal mining; University of New Brunswick; N-138b, maps C-69, 73.
- climate N-138a.
- Frederikshavn** (*Frédéricks-havn*), Denmark; northernmost seaport of Denmark, 36 ml. n.e. of Aalborg, on the Kattegat, pop. 18,391 D-68, maps D-71, E-424.
- Frederonia**, N.Y., village 45 ml. s.w. of Buffalo, pop. 7095; grape-growing section; first to use natural gas for lighting (1821); State Teachers College; map N-204.
- Frederikshald**, Norway. See in *Index* Halden.
- Frederikstad**, Norway, seaport and manufacturing town at mouth of river Glommen, 50 ml. s.e. of Oslo; pop. 14,326; export lumber trade; Hanks, most fashionable Norwegian resort, nearby; map D-416.
- Free association, in psychoanalysis P-424b.
- Freeboard**, on ships S-150. See also in *Index* Nautical terms, table.
- Free city**, city with an independent government D-64, C-324. See also in *Index* City-states.
- Bremen B-300.
- Danzig D-17.
- Frankfurt F-278.
- Hamburg H-262.
- Hanseatic League H-260-1.
- Freedman**.
- Greek S-195.
- Roman S-196.
- Freedmen's Bureau**, established by U. S. Congress at close of Civil War R-86b, picture R-86a.
- Johnson opposes J-359.
- Freedom**. See in *Index* Liberty.
- Freedom**, Medal of, U. S. D-39.
- Freedom of Information and the Press**, United Nations subcommission U-243.
- Freedom of speech** B-145.
- Alien and Sedition Acts A-167.
- Constitution guarantees U-353.
- Russia R-283.
- Freedom of the press**.
- Alien and Sedition Acts A-167.
- Bill of Rights B-145.
- Charles X of France suppresses C-194.
- Constitution guarantees U-363.
- established in America N-214.
- Jefferson and J-332c.
- Milton's "Areopagitica" M-268.
- Russia R-295, 283.
- United Nations convention on U-242.
- Zenger's trial N-214.
- Freedom of the seas**, in international law I-191.
- one of Fourteen Points W-149.
- Freedom Pledge**, a pledge sometimes used in U. S. schools; appears in "Education for Freedom", a bulletin of the U. S. Office of Education; I am an American. A free American.
- Free to speak—without fear.
- Free to worship God in my own way.
- Free to stand for what I think right.
- Free to oppose what I believe wrong.
- Free to choose those who govern my country.
- This heritage of Freedom I pledge to uphold.
- For myself and all mankind.
- Freedoms Foundation, Inc.**, a non-profit, nonpolitical, nonsectarian foundation chartered in 1949 with the aim of making awards to Americans for contributions to a better understanding of freedom by the things they write, do, or say; headquarters Valley Forge, Pa.
- Freedom Train**, a red, white, and blue train for carrying and displaying U. S. historic documents and flags to remind U. S. citizens of nation's ideals (Documents date from 1493 to 1945 and include Jefferson's draft of Declaration of Independence.) Train began tour across nation 1947; in Philadelphia, Pa., was first opened to public (Sept. 17). Tour sponsored by Attorney General Tom C. Clark, endorsed by President Harry S. Truman, and directed by the American Heritage Foundation; tour ended January 1949.
- Free enterprise**, or individual enterprise, in economics E-223-9, I-137-8.
- In America I-116-20, *Reference Outline* I-119-20.
- Free fall**, or free drop. See in *Index* Aviation, table of terms.
- Free French** W-251.
- De Gaulle G-34.
- Freehold**, in law. See in *Index* Law, table of legal terms.
- Freeman**, Douglas Southall (1886-1953), editor and author, born Lynchburg, Va.; editor *Richmond News Leader* 1915-49; professor of journalism Columbia University 1934-41; Pulitzer prize (1935) for biography "R. E. Lee" ("The Last Parade"; "The South to Posterity"; "Lee's Lieutenants"; "George Washington").
- Freeman**, Edward Augustus (1823-92), English historian, born Stafford, England; among his many historical works, the most famous is "History of the Norman Conquest" quoted G-210, H-360.
- Freeman**, Mary Eleanor Wilkins (1852-1930), short-story writer and novelist, born Randolph, Mass.; at her best in portraying repressed lives of New Englanders ("A New England Nun", short story; "Jane Field" and "Pembroke", novels; "The Wind in the Rose-Bush", ghost story; "The Long Arm", detective story); A-229.
- Freeman**.
- In Middle Ages M-238.
- Freeman's Farm**, battles of. See in *Index* Saratoga, battles of.
- Freemasons**, secret fraternity F-283.
- Free metal**, a metal, such as gold, found free in nature, not combined with other elements, table M-176.
- Free Methodist church**, developed from the Methodist Episcopal church; organized 1860 at Pekin, N.Y., to bring about a return to Methodism as originated by Wesley; adopted doctrine of Methodist Episcopal church with added belief in entire sanctification (freedom from inward sin) and in a stricter view regarding general judgment and future reward and punishment.
- Freeport**, Ill., city in n.w., 105 ml. n.w. of Chicago; pop. 22,467; varied manufactures including electric dry cell batteries, cheese, toys; maps I-36, U-263.
- Lincoln-Douglas debate L-262.
- Freeport**, N.Y., residential suburb of New York City on s. shore of Long Island; pop. 24,680; map, inset N-204.
- Freeport Doctrine** L-252.

- number of people speaking L-98
Switzerland S-480, 481
French Lick, Ind., resort town in s.w., about 65 mi. n.e. of Evansville; pop. 1946; saline-sulfur springs: map I-79
French literature F-286-91, pictures F-286-9, Reference-Outline L-99. See also in Index names of chief writers
chief writers, list F-290-1
drama D-132, 133
chief dramatists, list D-136
Cornelle and French tragedy C-485-6
Hugo shatters traditions H-441
Molière develops comedy of manners M-332
Racine departs from set rules R-24
early romances R-179: 'Song of Roland' R-178, S-415
essay of Montaigne E-397, M-366
folk and fairy tales L-270, S-415-16, list S-422
French Academy, influence of A-5
golden age under Louis XIV F-287-8
modern trend F-289-90
naturalist school Z-352
novel F-288-90
realists and naturalists F-288, D-133
Revolution, effect of F-288
romanticists F-288: Hugo H-441
salons, influence C-458
French Morocco, or French zone of Morocco, French protectorate comprising nearly all Morocco: about 153,910 sq. mi.; pop. 2,003,955; cap. Rabat M-393-4, 395, maps A-167, A-46, pictures M-394
donkey train, picture A-52
flag F-136d, color picture F-134
products M-393-4, C-372
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French Oceania, See in Index French Settlements in Oceania
French philosophers P-204
French poodle. See in Index Poodle, subhead standard
French Provincial style, in decoration I-180, pictures I-184, 185
French Revolution (1789-95) F-291-5, pictures F-291-2, 294, Reference-Outline F-274b
Austria and Prussia hostile to new order in France F-293
Bastille falls F-293, picture F-291
calendar changed F-294, W-85, C-23
Carlyle's history of C-123
causes F-291-2, F-268: Rousseau R-236; Voltaire V-523
clergy oppose F-293
Committee of Public Safety F-294
conscription W-10
Danton D-15
Declaration of Rights of Man F-293, B-145
English views: Burke B-358; Paine P-19b
Estates-General meets F-292, E-399
Europe, effects on E-433, F-269
Jacobin party J-290, F-294
Lafayette's part L-85
Lavoisier F-73, picture L-139
literature influenced F-288
Louis XVI L-320-1
Madame Roland executed R-179
Marat M-91b-2
Marie Antoinette M-95-6
'Marseillaise' X-40: words N-42
Mirabeau M-293
monarchy overthrown F-293
Napoleon and N-6-7
Netherlands N-121
nobles renounce privileges F-293
Reign of Terror F-294
Robespierre R-163, F-294
'sans culotte' D-147
serfdom ended S-197
Talleyrand in Directory T-8
'X Y Z' Affair with U. S. X-332
French rose R-230
French seam S-112
French Settlements in India, French territory on peninsula of India; consists of four settlements: Pondichéry, Karikal, Mahé, and Yanam; total area 192 sq. mi.; pop. 348,758; a former settlement of French India is Chandernagor, which merged with India in 1950: map I-68a
French Settlements in Oceania, overseas territory of French Union, in the Pacific Ocean, composed of Marquess Islands, Tuamotu Archipelago, Society Islands (including Tahiti), and Tubuai Islands: total area 1545 sq. mi.; pop. 55,734; cap. Papeete, on Tahiti: map P-17. See also in Index island groups and islands by individual name
French Somaliland, also French Somal Coast, French territory in n.e. Africa bordering Gulf of Aden; about 4300 sq. mi.; pop. 44,800; cap. Djibouti: maps A-46, A-285, D-402
relationships in continent, maps A-46-7, 41-2, 39
French Sudan, territory in French West Africa, formerly called Upper Senegal-Niger; includes w. part of Sudan approximately 451,000 sq. mi.; pop. 3,137,000; cap. Bamako: S-441, map A-46
people A-40, map A-39
Freetown, former village on site of present Monroe, Mich., on Raisin River 35 mi. s.w. of Detroit; Americans defeated by British and Indians, 1813, followed by massacre of wounded Americans (Raisin River Massacre)
French Union, French Union française (*ü-nyöñ' fräñ-sëz'*), federation consisting of French Republic and its overseas departments and territories and the associated states F-267, list F-258, table F-267
French West Africa, French overseas territory in w. Sahara and adjacent coastal regions; cap. Dakar. French West Africa comprises the territories Mauritania, Senegal, French Guinea, Ivory Coast, French Sudan, Niger, Dahomey, and Upper Volta; total area, approximately 1,805,000 sq. mi.; pop. 16,377,000: map A-46. See also in Index names of territories
diamonds D-78
relationships in continent, maps A-46-7, 41-2, 39, 51
Sahara S-14-16, pictures S-15-16
transportation on Niger N-236a
French West Indies, collective name for French overseas departments of Guadeloupe and Martinique in West Indies G-221, M-104, map W-96a. See also in Index West Indies
Freneau (*frë-nö*), Philip (1752-1832), poet and journalist, born New York City; edited anti-Federalist *National Gazette*, Philadelphia (1791-93) ('The British Prison Ship'; 'Eutaw Springs'; 'The Indian Burying-Ground'): A-226a
Freusén, Gustav (1863-1945), German novelist; for several years was a village pastor; later devoted all his time to writing; 'Jörn Uhl', novel of peasant life: G-85
Freon, trade name for several related halogenated hydrocarbons; solvent for DDT and other insecticides
refrigerant R-95
Frequency, physics, vibration rate alternating current E-306
audio-frequency, in radio R-36, 38-9
electromagnetic radiations E-344b, R-29, 30b, diagram E-344b, table R-30
high frequency R-40-1: from a magnetron E-321, diagrams L-320; transmitting R-41; vacuum tubes as generators E-320-1
radio R-33-42: audio-frequency R-36, 38-9; frequency modulation R-45; range of waves on electromagnetic spectrum, diagram E-344b, table R-30
sound waves S-238, diagram S-240
television, modulation T-54a
Frequency distribution, in statistics G-163, graphs G-163-4
graphs S-385d-c, graphs S-385d-e
tables S-385c-d, tables S-385c-e
Frequency modulation (FMI) E-321
radio R-45
television T-54a
Frequency polygon, a line graph G-163-4, S-385d, graphs G-163-4, S-385d
rectangular G-163
Frère (*frër*), Sir (Henry) Bartle (1815-84), English administrator, nephew of John Hookham Frere; governor of Bombay 1862-67; as special commissioner to East Africa influential in abolishing slave trade in Zanzibar, as governor of Cape Colony 1877-80 attempted confederation of South Africa.
Frere, John Hookham (1769-1846), English diplomat and author, uncle of Sir Henry B. Frere; minister to Portugal 1800-1802, to Spain 1802-4 and 1808; superior verse translations of Aristophanes' plays
Fresco, method of painting on fresh plaster P-37c. See also in Index
Mural painting
Giorgione G-110
Giotto G-110, 111, picture C-293, color picture P-25
Michelangelo, Sistine Chapel S-175, M-212, 214, picture M-213, color picture P-27
Raphael R-74
Vincent, Leonardo da, picture V-473
Frescobaldi (*frës-kö-bäl'dë*), Girolamo (1583-1643), Italian composer and organist, born Ferrara; organist at St. Peter's in Rome 30 years; composed for organ, also for voice.
Fresenius (*frä-zä-ni-us*), Karl Remigius (1818-97), German chemist, born at Frankfurt-on-the-Main; founder of chemical laboratory at Wiesbaden Agricultural Institution.
Freshman, in college C-383
Fresh-water clam C-338-9, picture C-338
Fresnel (*frä-nöl*), Augustin Jean (1788-1827), French physicist; demonstrated (after Young but independently) wave theory of light; established mathematical analysis of optical phenomena; contributed theory that light waves are transverse; changed entire world's light-house illumination ('Fresnel system'): L-233, P-234
Fresno, Calif., city 162 mi. s.e. of San Francisco; pop. 91,669; F-295, maps C-35, U-252, picture F-295
climate C-38
Millerton Lake N. R. A. N-38d
Fresno State College, at Fresno, Calif.; state control; founded 1911; arts and sciences, agriculture, education; graduate studies.
Fret, or latticework, in furniture design I-178, 179, pictures I-180, 181
Fread (*fröid*), Sigmand (1856-1939), Austrian neurologist and psychiatrist F-295-6, picture F-295
cocaine as anesthetic A-246
mind, nature of M-261
psychoanalysis P-124b-5, P-427-427a
Frey (*frä*), in Norse mythology, god of peace, prosperity, and fruitfulness, brother of Freyja.
Freyja (*frä-yä*), Freyja, or Freya, in Norse mythology, goddess of love, sister of Frey.
Freytag (*frä-täk*), Gustav (1816-95), German novelist and playwright;

- Frölich (frä'lik), Theodor Christinn Brun (born 1870), Norwegian physician, professor of medicine at Royal Frederick University, Oslo experiments with scurvy V-497
- Frome (fröm), Lake, in e. South Australia, maps A-489, 478
- Fromentin (frö-män-tän'), Eugène (1820-76), French painter and author; best known for paintings of North Africa; wrote and illustrated book on Sahara; also wrote a novel ('Dominique') and a work on Dutch and Flemish painting.
- Frome River, in England, flowing 20 mi. into the Avon; Bristol is located at its junction with the Avon River.
- Fromm, Erich (born 1900), American psychoanalyst, born Germany; became U. S. citizen 1940; on faculty Bennington College, Bennington, Vt., after 1942; author of 'Man for Himself; an Inquiry into the Psychology of Ethics'; 'Psychoanalysis and Religion'; 'The Forgotten Language'; P-425
- Fronde, leaf of fern F-52, 53, pictures F-52
- Fronde (frönd), The, a civil war in France during minority of Louis XIV (1648-52) and the consequent war with Spain (1653-59), so called (fronde, "sling") from free use of silngshots by the Paris mob; its suppression contributed to the growth of absolutism under Louis XIV. Also name of the political party that opposed the king.
- Front, in weather forecasting W-79-80, mops W-79-81
- Frontal bone, the bone forming the forehead, or front of the cranium S-192, pictures N-305, S-192
- Frontal lobe, of brain B-280, 281, picture B-279
- mental activity, relationship to B-282
- prefrontal lobotomy B-283
- Frontenac (frön'tän-äk, French frönt-näk), Count Louis de (1620-98), governor of New France F-301, picture C-95b
- Cadillac and C-10
- fort at Kingston K-47
- Joliet and J-362
- LaSalle and L-104, 105
- Frontenac, Château, hotel in Quebec Q-10, picture Q-9
- Frontera (Spanish for "frontier"), in Chile C-255
- Front gate, of Peking, picture P-111
- Frontier, in America. See in Index Far West; Pioneer life in America
- Frontier Days, Cheyenne, Wyo., celebration C-228, C-317, W-326
- Frontinus (frön-ti'nüs), Sextus Julius (1st century A.D.), Roman soldier and writer; governor of Britain 75-78; as water commissioner of Rome, wrote 'De aquis urbis Romae' (On the Aqueducts of Rome).
- Front Range, e. range of Rocky Mountains, in n.-central Colorado; contains Pikes Peak and Longs Peak; R-173, maps C-408-9, U-296-7
- Rocky Mountain National Park N-38b, color picture N-24, maps C-408, N-18
- Front Range, a range of Rocky Mountains in British Columbia, Canada B-313
- Front Royal, Va., town, county seat of Warren County, 105 mi. n.w. of Richmond; pop. 8115; "Stonewall" Jackson defeated Colonel Kenly May 1862; maps V-487, C-335
- Frost, Arthur Burdett (1851-1928), illustrator and author, born Philadelphia, Pa. ('Bull Calf and Other Tales', 'Carlo')
- 'Uncle Remus' illustrations L-269, pictures L-210, 214, H-272
- Frost, Edwin Brant (1866-1935), astronomer, born Brattleboro, Vt., studied in Germany and United States; professor astronomy and director observatory, Dartmouth College, professor astrophysics University of Chicago and director Yerkes Observatory; important work in stellar spectroscopy; became blind in later years but continued work ('Let's Look at the Stars').
- Frost, Frances (born 1905), writer, born St. Albans, Vt.; instructor creative writing University of Vermont 1929-31 (poems: 'These Aeres', 'Pool in the Meadow', 'Mid-Century'; novels 'Innocent Summer', 'Yoke of Stars', 'Village of Glass'; books for children: 'Maple Sugar for Windy Foot', 'The Little Whistler').
- Frost, Grandfather, Russian Santa Claus R-273
- Frost, Robert (born 1874), American poet F-301-2, A-230c, picture F-302
- portrait by Walter Haneock S-74, pictures S-74
- quoted P-336, A-400d, C-319b
- Frost F-302-3, picture F-302
- crop protection F-303, F-306, O-402
- Frostbite, treatment of F-98
- Frosted glass
- electric light bulb G-122b
- Frothfly. See in Index Froghopper
- Froude (fröd), James Anthony (1818-94), English historian, often prejudiced but a master of style ('History of England from the Fall of Wolsey to the Defeat of the Spanish Armada'; biographies of Thomas Carlyle, Julius Caesar, Disraeli).
- Frozen insects B-51
- Frozen foods F-222-3, R-96, V-497
- fish F-113
- storage methods, picture F-222
- Fruitec, levulose, or fruit sugar, a simple (monosaccharide) sugar (C₆H₁₂O₆), one and three fourths times as sweet as cane sugar: S-446, 447
- artichokes contain A-394
- bacteria make B-15
- fermentation Y-337
- molecular formula O-424c, diagram O-424c
- polariscope test L-235
- Fruit, in botany, the matured seed container of a flowering plant F-306
- classification F-306
- dispersal S-96, W-66-7
- Fruit and fruit growing F-303-12, pictures F-304-6, color pictures F-307-12, Reference-Outline A-72. See also in Index names of fruits, as Apple, Orange
- canning F-219-22
- cold storage C-381, F-303-4
- dehydration F-223-4; prunes F-424, picture P-424; raisins R-72
- diseases and pests
- bats B-78
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- fungi: blight B-206; mildews and molds M-247-8
- grape phylloxera G-155, 166
- Mediterranean fruit fly I-163, F-189
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- rabbit, picture F-305
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- weevils W-85
- food value F-217, F-207
- history of F-303-4
- apple cultivation A-277-8
- Crusaders bring new varieties to Europe C-522
- grape culture G-155-6
- importing new varieties to America A-65; apple A-278; cherry C-223a; grapefruit G-154; melons
- M-168; orange O-400; pear P-105; plum P-322
- how fruits develop F-186
- improvement and new varieties F-303; Burbank's experiments B-356, 357. See also in Index Plant Improvement
- orchard management F-304-6, pictures F-304-6
- cover-crop F-305
- electric power equipment A-61
- frost protection O-402, F-306
- grafting F-303, pictures F-305; grapes G-155, 156
- picking and marketing F-304-5, picture A-355
- pruning F-306, G-156, picture F-304
- sorting and packing: oranges, pictures O-401; prunes P-424
- sprays and spraying S-356-7, table S-357
- tree surgery T-185
- pollination. See in Index Pollen and pollination
- rare tropical fruits F-304
- seedless varieties: orange O-400; pineapple P-250
- United States industry F-305; California C-40, picture C-25, color picture U-305; Florida F-151; Michigan M-218; rare tropical fruits F-304; West Virginia W-100
- Fruit flies F-189, H-346
- chromosomes, picture H-347
- Mediterranean fruit fly I-163-4
- Fruit sugar. See in Index Fructose
- Fru'menty, nn old English breakfast dish B-299
- Frunze (frun'zë), formerly Pishpek, Russia, industrial city about 150 mi. s. of Lake Balkhash; capital of Kirghiz Soviet Socialist Republic; pop. 140,000; map A-406
- Frustules (früs'tülz), of diatoms D-82
- Frustum, of a pyramid or cone, diagram G-61
- Fry, Christopher (born 1907), English dramatist, born Bristol, England ('Venus Observed'; 'The Boy with a Cart'; 'A Sleep of Prisoners')
- 'The Lady's Not for Burning' L-88c
- Fry, Elizabeth Gurney (1780-1845), English Quakeress and prison reformer P-416
- Fry, Roger Elliot (1866-1934), English painter and art critic; paintings show fine sense of form and design; published works include 'Vision and Design' and 'Architectural Heresies of a Painter'
- Fry and advanced fry, in fish culture F-109, picture F-109
- Fryc, William Pierce (1831-1911), legislator, born Lewiston, Me.; attorney general of Maine 1867-69; representative in Congress 1871-81; U.S. senator 1881 until death; member of Peace Commission at Paris, France, in 1898; as chairman of commerce committee influenced American legislation.
- TSA. See in Index Federal Security Agency
- FSA (Farm Security Administration), U. S. R-205, U-365
- FSGO (Federal Surplus Commodities Corporation), U. S. R-205
- Fund (fo-äd'), I. Ahmed Ali Pasha (1868-1936), king of Egypt; became sultan 1917, proclaimed king 1922, upon removal of British protectorate: E-278
- Fund University, at Cairo, Egypt C-16
- Fuca (fo'kä), Juan de, real name Apostolos Valerianos (died 1602), Greek navigator; served in Spanish navy; explored n.w. coast of North America
- Puget Sound explored O-410
- Fuchow, China. See in Index Foochow

Key: cape, ät, far, föst, what, igll; mä, yet, fërn, there; fee, bit; rōw, won, fōr, nōt, dq; eüre, büt, rjde, full, bürn; out;

- Fuchs** (*fʏks*) Leonhard (1501-66) German botanist and physician born Bavaria one of the fathers of science of botany wrote *De historica stirpium thesaurus* is named for him
- Fuchsia** (*fʊʃiə*) an ornamental plant F 313, picture F 313
- Fudge box**, in new paper N 188
- Fuehrer** or **Führer** (*deɪ fʊɪrə*) German leader F 44
- Hilfer** H 383-5 pictures II 383-4
- Fuji** F 313-15, short F 314 See also in *Index* principal topics listed below
- acetylene A 7-8
- alcohol A 145 F 314
- atomic source A 489
- briguettes N 252
- British thermal unit II 319
- carbon forms C 120
- chemical C 186, F 313
- coal C 381-70, pictures C-381-70
- coal tar pitch C 371
- coke C 360
- combustion F 73-4
- gas G 30-3 pictures G 30-2
- essence G 33 P 176-8
- lignite C 363 N 281 282 T 76
- measure or dung A 248 U 188 bi 343
- measurement of heat, calories C 48
- mesquite used for M 176
- national power and F 314 15
- pest P 108-9 C-363 F 313 picture P 108
- petroleum P 188-81 map P 188, picture F 188
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- plants used for P 301
- smoke S 201 2
- sugar-cane stalks or bagasse S 448
- supplies U S 319
- wood F 313-14 C 80-1, A 201 308
- short F 314
- Fuel Administration**, U. S., in World War I W 936
- poster picture W 237
- Fuel** site certain petroleum products F 314 charts F 314 F 176-7
- Fuel value** of food F 316-17 II 302, charts F 311 318
- Fuenterabía** (*fʊntɛr-ri-tyd*) or **Fuenterabía** (*fʊntɛr-ri-tyd*) Spain town on French frontier on Bidassoa River famous fortress destroyed by French 1794 Wellington crossed Bidassoa near here in 1813 in spite of French opposition
- Fuerte** (*fʊɪɪt*) river in W. Mexico 180 mi to Gulf of California maps M 188 184
- Furter** (*fʊɪɪt*) Spanish *fuerte* (see) Louis Arago (1747-1827) painter and naturalist born Ithaca, N. Y. celebrated for his paintings of birds which are accurate and realistic
- Fugger** (*fʊgə*) wealthy family of German merchants and bankers famous in 16th century founded by Johann Fugger Bavarian weaver in 14th century
- Fugitive slave law** U. S. laws passed in 1793 and 1850 which provided for the return of escaped Negro slaves from one state or territory to another state
- Compromise of 1850 C 332
- Dred Scott Decision D 141
- Fillmore and F 67
- Wendell Phillips attacks picture U 331
- Yagur** (*fʊgə*) in music M 482 See also in *Index* Music, table of musical terms and forms
- Führer** See in *Index* Fuehrer
- Fujiwara** (*fʊdʒi-wa*) a powerful Japanese family founded by Fujiwara Kametari (614-699) prominent in civil affairs until crushed by Minamoto Yoritomo 1189 J 318
- Fujiyama** (*fʊdʒi-yo-ma*) Fuji or Fuji-san sacred mountain of Japan 70 mi s.w. of Tokyo 12 661 ft high J 283 maps J 287 A 488 picture J 295
- bright comparative See in *Index*
- M units 4 table
- national park N 39
- Fukien** (*fʊk-i-en*) China maritime province in s.e. 61 275 sq mi pop 13 142 721 cap Foochow map C 289
- porcelain making F 396a
- Indo or Indo a numerous and powerful African people scattered over a wide area from near w. coast to Anglo-Egypt an Sudan have well marked features and are light in color probably Berber in origin with some Negro blood chiefly a wandering past rat people religion Mohammedan
- Fulbright** (*fʊl-braɪt*) William (born 1905) political leader born Sumner Mo. resident University of Arkansas 1933-41 U.S. representative from Arkansas 1943 45 U.S. senator since 1945 chairman Senate Banking, RFC 1348-51
- Fulbright** fellowships E 282
- Fulcrum** fixed point about which lever turns M 160 picture M 160a
- knife edge W 85
- Fulda** (*fʊldə*) Ludwig (1870-1930) German dramatist wrote *The Traillmas* *The Lost Paradise* translated works of Molière Beaumarchais and Rostand
- Fulcrum** (from *fulcrum* light) tubes (a) made of rock made by lightning passing through these materials and fusing them also materials that have been fused on the surface by lightning
- Full Employment Act** of 1916 U.S. L 709
- Feller** Ben Hebard (1870-1937) major general head of U.S. Marine Corps (appointed 1930) born Big Rapids Mich. joined Marine Corps 1891 as second lieutenant served in Spanish American War with Marines in Philippines 1898-1901 in Santo Domingo 1901-19 and in Haiti 1924-25
- Feller** George (1822-84) figure and landscape painter born Deerfield Mass. (The Romney Girl The Turkey Pasture Quadrone She Was a Witch)
- Feller** Henry Blash (1857 1925) novelist and literary critic born Chicago Ill. work shows charm and grace of style good taste and wide knowledge of literature The *Garden of this World* are stories of travel in Europe The *Cult of Dollars* is about life in Chicago
- Feller** Lela (1902-1948) actress and dancer born near Chicago in DuPage County Ill. originated serpentine dance had a dancing school in Paris France after 1929 (Fifteen Years of a Dancer's Life) D 145
- Feller** Margaret in full *Margaret Margaret* (1810-1892) writer born Cambridgeport, 603 Mass. brilliant and advanced thought remembered chiefly for her association with Emerson first scandalists and Emerson's first editor of the *Dial* married in Italy entered the struggle for Italian independence drowned at sea (Woman in the Nineteenth Century) Papers on Literature and Art
- Cambridge home C 88
- Feller** Melville Weston (1873-1910) jurist, born Augusta, Me. chief justice U.S. Supreme Court 1898-1910 deals on aided growth of federal power
- Feller** Thomas (1608-61) English clergyman and writer style vigorous and full of humor chaplain to Charles II (History of the Worthies of Cheshire) quoted S 120
- Feller** Thomas (1822 98) Canadian architect, born in England New York State Cap tol picture N 212
- Fellur** earth a claylike substance F 31a
- variety of koolin M 268
- Feller** (tree) a plant used for fulling cloth T 120 picture T 120
- Fellurian** Calif. city 22 mi s.e. of Los Angeles pop 13 958 food processing and cannina citrus fruit products and juicers precision instruments glass products Fullerton Junior College map inset C 35
- Fell** faded house S 397
- Felling** or **millin** a process in the manufacture of woolen cloth W 187
- Fell** plant used T 120 picture T 120
- Fell** moon M 384 388 diagram M 355
- Fell** rigged ship S 150 picture S 151
- Fell** raised in sculpture S 74
- Fellmar** a gull like bird belonging with the petrels to the family *Procellariidae* plumage white except for gray back and tall bill stout and hooked ranges over North Atlantic wintering south to Georges Bank off Massachusetts
- Fellmar** a highly explosive salt of (nitro) acid (CNUH) used as primer to set off explosive also other substances which explode at a blow F 78 79
- mercury** E 437 489
- silver** S 188
- silbilla** M 268
- Fellmar** Robert (1765-1815) Amer. (can) inventor of steamboat F 318
- Cartwright** aided in steamboat prob. (can) C 130
- Clement** F 315 picture F 315
- patented table I 109
- Hall of Fame** table H 848
- Invent** submarines S 453
- Statuary Hall** See in *Index* Statuary Hall (Pennsylvania) table
- submarine** development F 318 S 457
- Fell** Mo. city 24 mi n.e. of Jefferson City pop 10 653 farming area shoes machinery airport in state inst. tut. on for deaf and blind Westminster College and Williams Woods College pop 24 mi n.w. of Syracuse on Onondaga River and Canal pop 13 958 paper prod. candy map N 205
- Famarale** (*fʊ-ma-rə-lə*) a small earth opening which ejects volcanic vapors
- Katmai National Monument** N 38
- A 132 map N 18
- shining for power V 620 picture V 620
- Yellowstone Park** Y 338
- Examination** A 485-6
- destroy** insect peste I 183 S 357, picture E 218 1 165
- formaldehyde** F 241-2
- use A 285-8
- Faming** sulfuric acid or ofram S 448
- Familly** family or *Familiaceae* (*fʊ-mi-l-i-ty*) a family of plants including the bleeding heart, squirrel corn Dutchman's breeches mountain fringe golden eardrops and corydalis
- Familly** (*fʊ-mi-l-i-ty*) capital of Ma. dest. pop 37 635 picturesque and well built streets sugar plantations and vineyards M 22 map A 45
- Fourtan** in mathematics a quantity which depends upon or is deter-

- mined by another quantity called a variable
 algebra A-157-9
 calculus C-184-c
 trigonometry T-167, 188, *graphs* T-189
- Functionalism**, in architecture A-324, *picture* W-308
 factories F-10
 livestock-judging pavilion *picture* N-278
- Functional psychology** P-426
- Fond** *See in Index* Foundations and charities
- Fundamental**, in music S-238, *diagram* S-240
- Fundamentalism**, religious movement in Protestant churches in United States which caused much conflict term refers to "fundamentals" which adherents believed were necessary to Christian religion such as literal interpretation of Bible
- Fundamental Orders** of Connecticut, early constitution H-279, C-449
- Fundy**, Bay of, large inlet of Atlantic between New Brunswick and Nova Scotia Canada N-138, *map* C-69
 plant life on shore *color picture* P-287
 tide N-138, T-130
 at St John New Brunswick N-138, *picture* T-131; Reversing Falls N-138, S-18
- Fundy Isles** N-138
- Fundy National Scenic and Recreational Park**, in New Brunswick, Canada N-38/, N-138, *map* N-38/
- Füüüü**, also Fyn, largest of Danish islands after Zealand 1144 sq mi, pop 338 013, chief city Odense D-68, *map* D-71
 country church *picture* D-69
- Funer**al customs and rites. *See in Index* Burial and funeral customs
- Fünfkirchen**, Hungary. *See in Index* P-65
- Fungi** (fün'gi), primitive plants without chlorophyll F-316, N-50, P-288-9, *pictures* F-316, N-50. *See also in Index* kinds of fungi listed below
- bacteria fission fungi E-12-15, *pictures* B-12-15
 blueberries need B-211
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 harmful to trees T-185; oak O-320
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 parasites and saprophytes distinguished F-316
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 slime molds S-199
 spraying hills S-356, 357, G-17
 symbiosis (lichen) L-220, P-80, *pictures* L-220
 yeasts Y-336
- Fuüüüü** S-356, 357, *table* S-357
- Fungus** gnat, minute fly of the family *Mucetophilidae*; larvae feed on fungus and decaying vegetation
- Funicular** railway, a cable railway, particularly one ascending a mountain weight of the ascending car is counterbalanced by the weight of the descending car
- Funk**, Casimir, or Kazimierz (born 1884), Polish chemist pioneer in vitamin research V-497-8
- Funk**, Isaac Kaufman (1829-1912), American Lutheran clergyman, publisher, and editor born Clifton Ohio one of founders of Funk and Wagnalls Co publisher of dictionaries and textbooks
- Funkia** *See in Index* Hosta
- Funn** bone, name given to that part of the ulnar nerve which lies near the bone at the back of the elbow joint pressure or blow at this point causes sharp pain to pass along arm to fingers
- Fun'tun**, Frederick (1865-1917), general born New Carlisle, Ohio, captured Aguinaldo 1901 administered martial law in San Francisco during the earthquake and fire 1906 commanded American forces in Vera Cruz 1914
- Fur**. *See in Index* Furs and fur trade
- Fur farming**. *See in Index* Furs and fur trade *subhead* fur ranching
- Furfural**, or *furfural*, an inflammable oily liquid made by distilling wood sugar bran corn-cobs oat hulls or straw etc with sulfuric acid, used in manufacture of lacquers, dyes resins, disinfectants photographic plates and as motor fuel
- Furies**, or *Eumenides* (u-men'i-dez), in Greek and Roman mythology, goddesses who punished crime F-316
- Furl** *See in Index* Nautical terms, *table*
- Furlong**, Charles Wellington (born 1874), explorer and writer, born Cambridge Mass first American to explore Tripoli and to cross through heart of Tierra del Fuego (The Gateway to the Sahara), Tripoli in Barbary
- Furlong**, a unit of long and surveyor's measure *table* W-87
 origin of word W-86
- Furman University**, at Greenville S.C., Baptist, founded 1826 arts and sciences graduate school
- Furnace** F-316-17. *See also in Index* Electric furnace
 copper roasting C-474
 fire prevention F-90
 glass-making G-121-2, *picture* G-120
 hot-water H-324, 325
 household types H-321-6
 humidifier H-323, *picture* H-322
 iron and steel industry *See also in Index* Electric furnace
 blast furnace I-238-9, 246, *diagrams* I-236, 240-1, *picture* I-239, *color picture* U-285; forerunner I-246
 iron smelting I-238-9, 242-3, 244, 247, *diagrams* I-236, 240-1, 242, *pictures* I-235, 239, 243, *color picture* U-285; first in America I-246, *picture* I-246
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 steelmaking I-242-3, 243-4, 244, 247, *diagrams* I-236, 240-1, *picture* I-244
 turbohearth I-248
 lime carbondum S-180; chromite C-300
 oil-burning H-322, *picture* H-322
 reverberatory C-474
 steam boiler S-388
 warm-air, or hot-air H-321-2, 323, 324
- Furoce**, atomic. *See in Index* Reactor, nuclear
- Furieux** (fur'no) Group, islands at the end of Bass Strait, between Australia and Tasmania, *maps* A-489, 478
- Furieux**, Hurace Howard (1833-1912), Shakespearean scholar, born Philadelphia, Pa
 'Variorum Shakespeare' S-131
- Furness**, England, district of n.w. Lancashire, peninsula across Morecambe Bay from rest of county, hematite iron ore, extensive ruins of famous abbey, early English chapter house and cloisters
- Furness**, Harry (1854-1925) Irish caricaturist, author lecturer, for
- many years on staff of Punch, to which he contributed 'Diary of Toby, M.P.' Illustrated works of Dickens and Thackeray, wrote and illustrated 'Confessions of a Caricaturist' and other books, a powerful versatile draftsman
- Furniture** F-317-20, *pictures* F-317-20 *See also in Index* Bed, Chair, etc
- Adam I-178, *picture* I-182
 ancient Egyptian F-319c, E-282, *pictures* L-281, I-319c; Greek F-319c, Roman F-319c
 Boule I-179
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 Chinese C-265
 Chippendale I-178, *pictures* I-180, 181
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- pioneers cabin P-263, *pictures* P-263, U-374
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 silicone polish S-180
 veneer V-440
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 woodworking and wood carving W-190-1
 X-ray tests X-331
- Furnivall**, Frederick James (1825-1910), English philologist, founded Early English Text Society, Chaucer Society, and other societies for publication of texts, edited 'Six-Text Print of Chaucer's Canterbury Tales', directed publication of 43 facsimiles of quartos of Shakespeare's plays, and many early English works
- Furphy**, Joseph (1843-1912), pseudonym Tom Collins Australian

[illegible]

(Continued on the next page)

4-Fren h German þen go /l/ in then t=French nasal (Jeau) sh=French *ſ* (s in azure) x=German guttural ch

PRINCIPAL FURS OF THE WORLD—Concluded

NAME OR TRADE NAME	TYPE OF ANIMAL	CHIEF SOURCE
Otter	Weasel	Regions throughout world
Otter, Sea	Weasel	Alaska and Kamchatka (Siberia)
Pahmi (Ferret-Badger)	Weasel	China
Persian Lamb. See Lamb		
Peschanik	Rodent	Siberia
Pony	Horse	Europe and South America
Rabbit	Rabbit	Regions throughout world
Raccoon	Raccoon	North America and South America
Raccoon, Asiatic	Dog	China, Japan, and Siberia
Raccoon, Mexican	Raccoon	Mexico and Central America
Sable. See also Marten	Weasel	
American (American Marten)		North America
Chinese		China
Russian		Siberia
Sable, Hudson Bay (correct term, American Sable)	Weasel	
Seal, Fur	Eared Seal (with external ears)	Alaska, South Africa, South America, Japan, and Siberia
Seal, Hair	Earless Seal (ears hidden)	North America and Scandinavia
Seal, Rock	Eared Seal	Chile and Peru
Skunk	Weasel	North America and South America
Skunk, Spotted	Weasel	North America
Squirrel	Rodent	Throughout Northern Hemisphere
Squirrel, Flying	Rodent	Pacific Islands off Asia
Sulik	Rodent	Siberia
Viscacha	Rodent	South America
Wallaby	Kangaroo	Australia
Weasel	Weasel	Throughout Northern Hemisphere
Weasel, Manchurian	Weasel	Manchuria
Wolf	Dog	Throughout Northern Hemisphere
Wolverine	Weasel	North America and Siberia

*Much like raccoon, but placed in a different family because of teeth. †Much like rodents, but placed in a different order because of teeth.
 ‡Classified as a marsupial; young are carried in abdominal pouch.

novelist, born near Melbourne, Australia; fame rests on novel, 'Such Is Life', one of the great books in Australian literature
Furring. See in *Index* Architecture, table of terms
Furs and fur trade F-321-6, pictures F-321-6. See also in *Index* names of principal fur-bearing animals. For list of principal furs, see table on this and on preceding page
 air conditioning, use of A-77
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 Canada C-87; Alberta A-143; Hudson's Bay Company H-438; Labrador L-76; Manitoba M-79, 80
 Eskimos E-395
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 fur ranching F-326; Alaska A-133, 134; Canada C-87; mnk M-275
 great trading companies: American Fur Company F-324, 325, S-296, 305; Hudson's Bay Company H-438, F-323-6, 1-23; North West Company F-324-5, B-316, N-293
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 French in America L-104, 105
 Indiana I-86
 Michigan M-220
 Minnesota M-280
 New York N-213
 North Dakota N-293
 South Dakota S-296, 305
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 tanning skins L-147-8
 trapping T-176-7, picture T-176
 Fur seal S-88-9, A-134, pictures S-89-90
 migration S-88-9, map M-241
 Fur seal arbitration (Bering Sea) S-90, H-276
 Furtwangler (*fort'veng-lér*), Wilhelm (1886-1954), German conduc-

tor and composer; has conducted regularly in Berlin, Vienna, and Milan, also guest conductor in U. S.; permanent director of Berlin Philharmonic Orchestra 1932-54.
Fury and Hecla Strait, in n. Canada, narrow channel from Gulf of Boothia to Foxe Basin, between Melville Peninsula and n.w. Baffin Island; map C-69
Furze, gorse, or whin, spiny shrubs comprising the genus *Ulex* of the pulse family native to Europe and n.w. Africa; used for fences, as winter food for livestock, and for fuel; *Ulex europaeus* has been introduced into the United States.
Fusan, Korea. See in *Index* Pusan
Fuse, in artillery shell A-398
detonator E-458
proximity fuse R-28, A-397, picture A-398
Fuse, electric E-303, A-173
safety in replacing S-8
Fused quartz Q-3
Fuselage (*fū-zē-līg* or *fū-zē-lāch'*), of airplane A-96, 100, diagrams A-87, 96, pictures A-97-9
Fuse lever, in flood control F-145
Fusel oil, a poisonous liquid consisting mainly of amyl alcohols formed in fermentation; used in paints and varnishes.
Fushun (*fū'shun'*), Manchuria, city 28 mi. e. of Mukden (Shenyang), on railway connecting Mukden and Peking (Harbin); pop. 279,604
 coal M-74
Fusing point. See in *Index* Melting point
Fusion, heat of H-319
Füssen (*fū'sēn*), Germany, historic town 58 mi. s.w. of Munich; peace signed here between Elector Maximilian III. Joseph of Bavaria, and Maria Theresa, 1745.
Fust, or Faust, Johann (died 1466?), German moneylender, associated with Gutenberg in invention of printing G-235, F-414d, picture G-234
Fustanella (*fūs-tā-nē'fā*), short, full, pleated white skirt of traditional Greek peasant costume; worn by evzones of Greek army; picture G-192

Fustian (*fūs'chān*), name given to various coarse cotton or cotton and linen fabrics, especially a corded cloth similar to corduroy.
Future Farmers of America F-3260-b, pictures F-3260-b
Future Homemakers of America, national organization of girls and boys studying homemaking in junior and senior high schools. Homemaking teachers and state supervisors of home economics education are advisers. Became national organization in 1945. Sponsored by American Home Economics Association and by Home Economics Education Branch, Office of Education, U.S. Department of Health, Education, and Welfare, Washington 25, D.C. In 1954, organization had 8896 chapters with 388,750 members. Chapters in 46 states and in Hawaii, Alaska, Puerto Rico, and Guam.
Future life. See in *Index* Immortality
Future Teachers of America, organization for high-school and college students preparing to be teachers; founded 1937 by Joy Elmer Morgan; a co-operative project of National Education Association and its affiliated state and local associations; 1600 high-school clubs and 532 college chapters in 1954; headquarters, Washington, D. C.
Futures, in economics B-214, E-228
Futurism, a movement of Italian origin, in literature, painting, sculpture, and music; flourished 1911-15
 painting P-38
 sculpture S-82-3, picture S-82
FWA (Federal Works Agency), U. S. R-205
Fyfe, Rose (born 1877), English writer of children's stories and poems, chiefly about fairies; also singer and lecturer; born Nottingham, England; taught school; studied music in London, Berlin, and Paris (poems: 'Fairies and Chimneys', 'The Fairy Flute'; stories: 'A Princess Comes to Our Town', 'Forty Good-Morning Tales'; plays: 'Eight Little Plays for Children').
Fyn, island, Denmark. See in *Index* Fünen